The Welding Engineer

Reg. U. S. Pat. Office

Founded by L. B. Mackenzie, 1916

MAY, 1929 VOL. 14, NO. 5

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22nd ANNIVERSARY
MAY 7, 1929

THE ALEXANDER MILBURN COMPANY
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BALTIMORE, MD.

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Another Large Automobile Manufacturer Uses Resistance Welding to Speed Up Production

The nine welds shown on the fender above are made simultaneously by the projection method. The machine which does the job is shown in the top illustration. The *ELKONITE* may be seen on the top parts of the cylindrical inserts which have been force-fitted into the electrodes on both the upper and lower jaws. To the left is shown a section of one of these inserts. The lighter part at the top is *ELKONITE* which has been brazed on to the shank of copper. These electrodes equipped with *ELKONITE*, tripled the weld production of the old method.

A LARGE automobile company located inside the Detroit territory is another of the many progressive manufacturers who have adopted resistance welding to maintain high speed production. One of their many welding operations is shown in the accompanying illustrations. The bracket connecting running board to the front fender is projection welded in *9 places simultaneously*. This one welding operation alone represents a considerable saving over the old method of riveting.

On this particular job, the *ELKONITE* DIES used stand up for 45,000 welds, make a *better* weld with *less* shrinkage, and greatly increase production because they require less redressing.

A comparison of the above figures which have been selected as typical of *ELKONITE* performance, indicates the superiority of *ELKONITE* DIES. They have not only proven to be the better dies for all general purposes but through their use, many new welding applications are now commercially practical. Our engineers will be glad to show you how *ELKONITE* can be profitably used on your resistance welding applications.

***ELKON*, Inc. (*ELKONITE* Dept.)**
Div. of P. R. Mallory & Co., Inc.
INDIANAPOLIS, IND.

*Name on request.

ELKONITE

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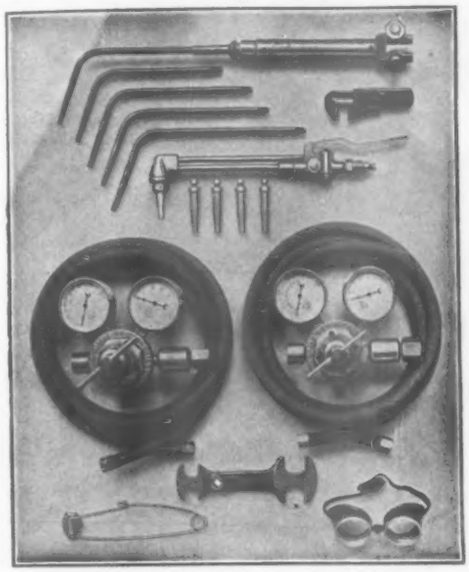

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Combination assembled as a Cutting Torch.

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8890 Attachment, 90° head, tips 2, 3, 4	17.50
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8800 Welding Torch, tips 6 to 10	25.00
8800 Welding Torch, tips 1 to 10, 2 mixers	37.00

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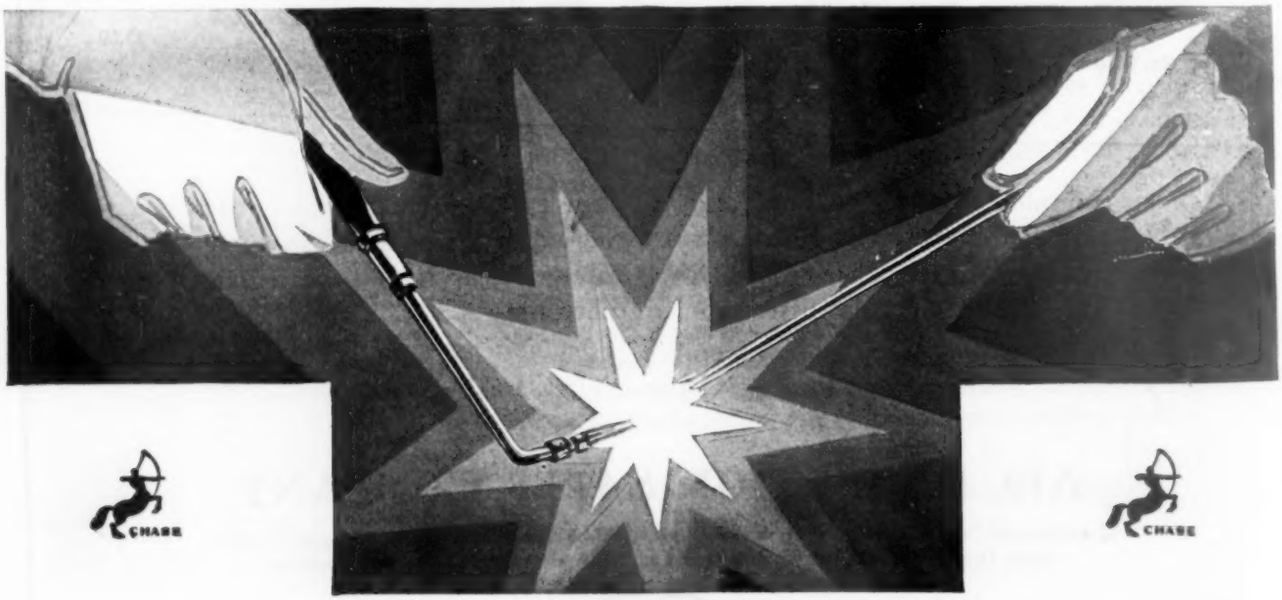

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The Welding Engineer

Founded by L. B. Mackenzie, 1916

Volume 14 | May, 1929 | Number 5

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You Can Always Go To This One

FROM May until October is the convention season—when professional men, tradesmen, and manufacturers meet with others of their craft, interchange ideas and visit the exhibitors of products suited to their business use.

The convention habit is a good one. It combines co-operation and mind-nutrition into one pleasant vacational undertaking.

Go to the convention—attend every one you can. You'll meet a bunch of the best fellows on earth and you'll get a wealth of good things from the sessions.

But supplement your attendance with regular visits to the "all year" convention which Uncle Sam brings to your door.

The "year round" convention for welding-minded men is The Welding Engineer.

Its editorial pages give nutrition to your mind,—the nutrition of subjects and news of your field.

Its advertising pages exhibit the new and improved products for your business use.

Start now. After attending the editorial or "convention" part of this issue, you can walk down the aisles of the advertising pages, looking at the manufacturers' exhibits there.

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Last Advertising forms close at 8:00 a. m. on the 12th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails. All copy should be in by the 12th of the month at the latest.

The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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SOUTH AFRICA—J. W. Arnison, 35a Victoria Ave., Benoni, Transvaal, South Africa.

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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See "Cutting Electrodes"

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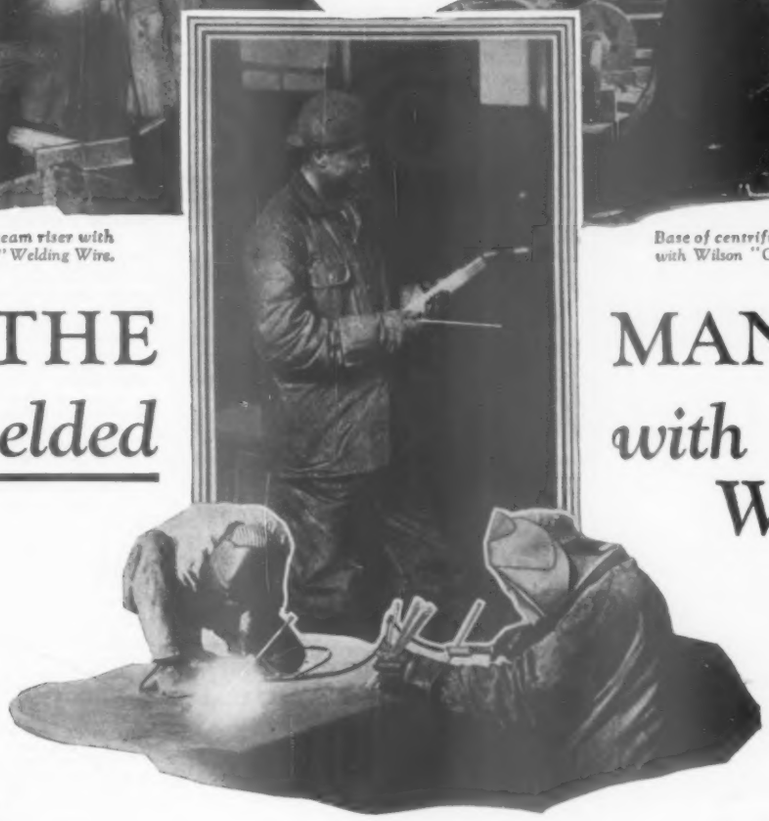

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See "Electric Resistance Welders"
SILVER SOLDER
Handy & Harman
SWEDISH IRON WELDING WIRE
Bissett Steel Co.
SPOT WELDERS
See "Electric Resistance Welders"
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International Oxygen Co.
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Better fitted—to serve!

To the skyline of Chicago has been added the gold leafed tower of the Carbide and Carbon Building. This new, majestically beautiful, forty-story structure rises more than 500 feet above Michigan Avenue at South Water Street. It is unique in architectural design—the first great building in Chicago to embody the free use of color in its exterior faces. The first major skyscraper in the country to have a completely welded piping system.

Under this one roof are being housed all the Central Division offices of the subsidiary companies of Union Carbide and Carbon Corporation.

This centralization of facilities,—Service, Engineering, Distribution, Sales—has been fostered by tremendous and unprecedented growth. It will assure a close co-ordination of departmental activities for the best possible service to the great and growing industries of the central west.

LINDE OXYGEN
The Linde Air Products Co.

Prest-O-Lite
Dissolved Acetylene
The Prest-O-Lite Co., Inc.

Oxweld
Apparatus and Supplies
Oxweld Acetylene Company

UNION CARBIDE
Union Carbide Sales Co.

Units of

UNION CARBIDE AND CARBON CORPORATION

General Offices
30 East 42nd Street
New York, N.Y.

UCC

Sales Offices
In Principal Cities
of the Country

64 Linde Plants—45 Prest-O-Lite Plants—154 Oxygen Warehouse Stocks—138 Acetylene Warehouse Stocks—38 Apparatus Warehouse Stocks—235 Carbide Warehouse Stocks

"These Five points favor the buyers of Harrisburg Forgings"

1. **Harrisburg owns and operates its own Open Hearth Furnaces, Blooming Mills and Rolling Mills.**
2. **Harrisburg's modern Forge Shops produce forgings made on hammers ranging from two thousand to eight thousand pound capacity.**
3. **Harrisburg is thoroughly familiar with the requirements of large users.**
4. **Large production enables Harrisburg to produce forgings at the minimum cost.**
5. **Harrisburg is not dependent upon other sources for steel. By making its own it can meet your requirements at all times.**

Let Harrisburg quote on YOUR specifications.

HARRISBURG PIPE & PIPE BENDING COMPANY, Harrisburg, Pa.

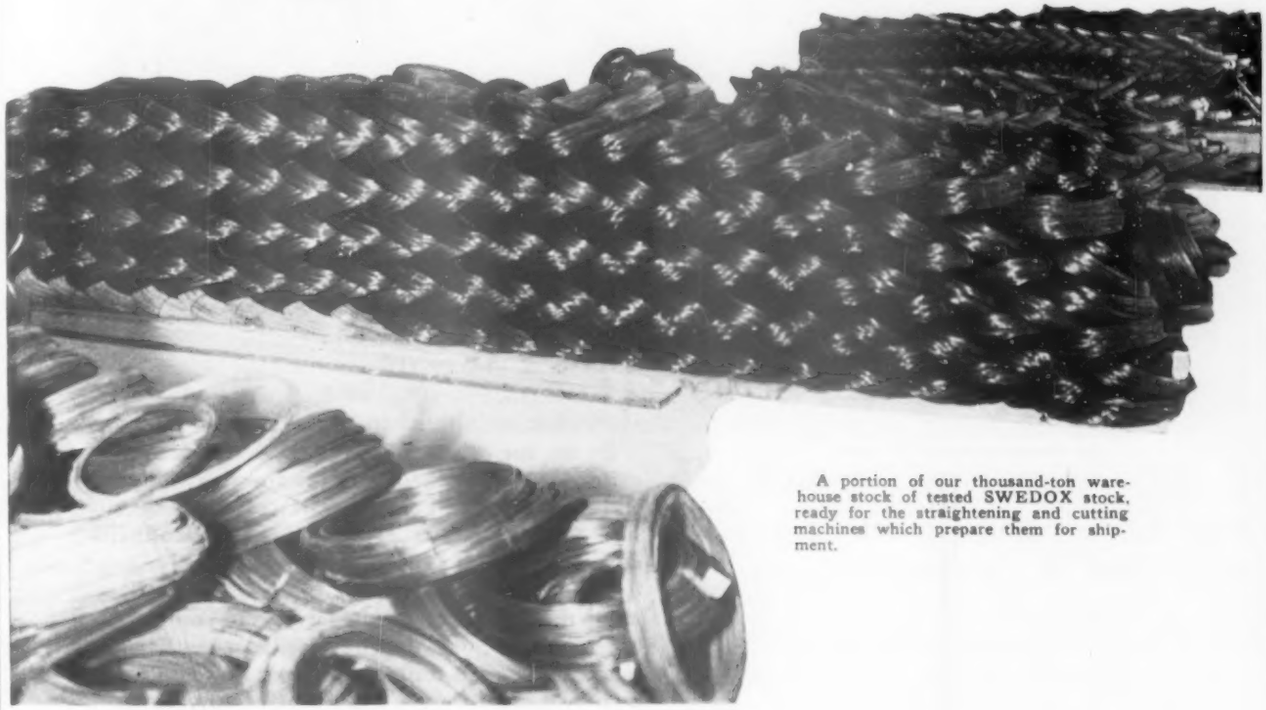
Fully Equipped with Our Own Open Hearth Furnaces, Rolling Mills and Forge Shops

Makers of Alloy Steels in Slabs, Billets, Bars, Strips, Shapes and Hollow Forgings; Pipe Coils and Bends, Couplings and Cylinders

HARRISBURG

ALLOY STEELS

Every coil has a reputation



A portion of our thousand-ton warehouse stock of tested SWEDOX stock, ready for the straightening and cutting machines which prepare them for shipment.

THE large stocks of SWEDOX which are waiting for your order represent more than mere tonnage. They consist of materials which have maintained a reputation for welding quality for many years. Every coil is made to a specification which has a national reputation for getting results. SWEDOX leadership, in fact, dates back to our pioneer work in welding wire research. You can be sure that the SWEDOX line includes a *proven* wire for your work.

Central Steel & Wire Company

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Lafayette 8500

DAYTON, OHIO
East Monument Ave.
Extended
East 150

DETROIT, MICH.
5001 Bellevue Ave.
Whittier 6780

SWEDOX

WELDING RODS, WIRES and ELECTRODES

This photograph shows the location of Haynes Stellite welding rod. A band approximately ½" wide and 3/64" thick is applied on the top of the cutting edge. The top and bottom sides of the point are also coated with Haynes Stellite welding rod 2" from the extreme point and ⅛" thick.

Long wearing plow shares

HAYNES STELLITED plow shares wear from four to five times as long as regular steel shares and cost less than twice as much.

By the use of the Stelliting process (the application of Haynes Stellite in the form of welding rod to wearing and cutting surfaces) farmers can now procure plow shares that will reduce their cost per acre.

Farm equipment dealers and welding shops—Develop this business with the farmers in your locality. You can apply Haynes Stellite to new and worn solid or soft center steel plow shares in your own shops and render a real service to your customers, with real profit to yourselves.

Write for our pamphlet describing in detail how Haynes Stellite is applied to this important part of the farmer's equipment.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

DISTRICT SALES OFFICES

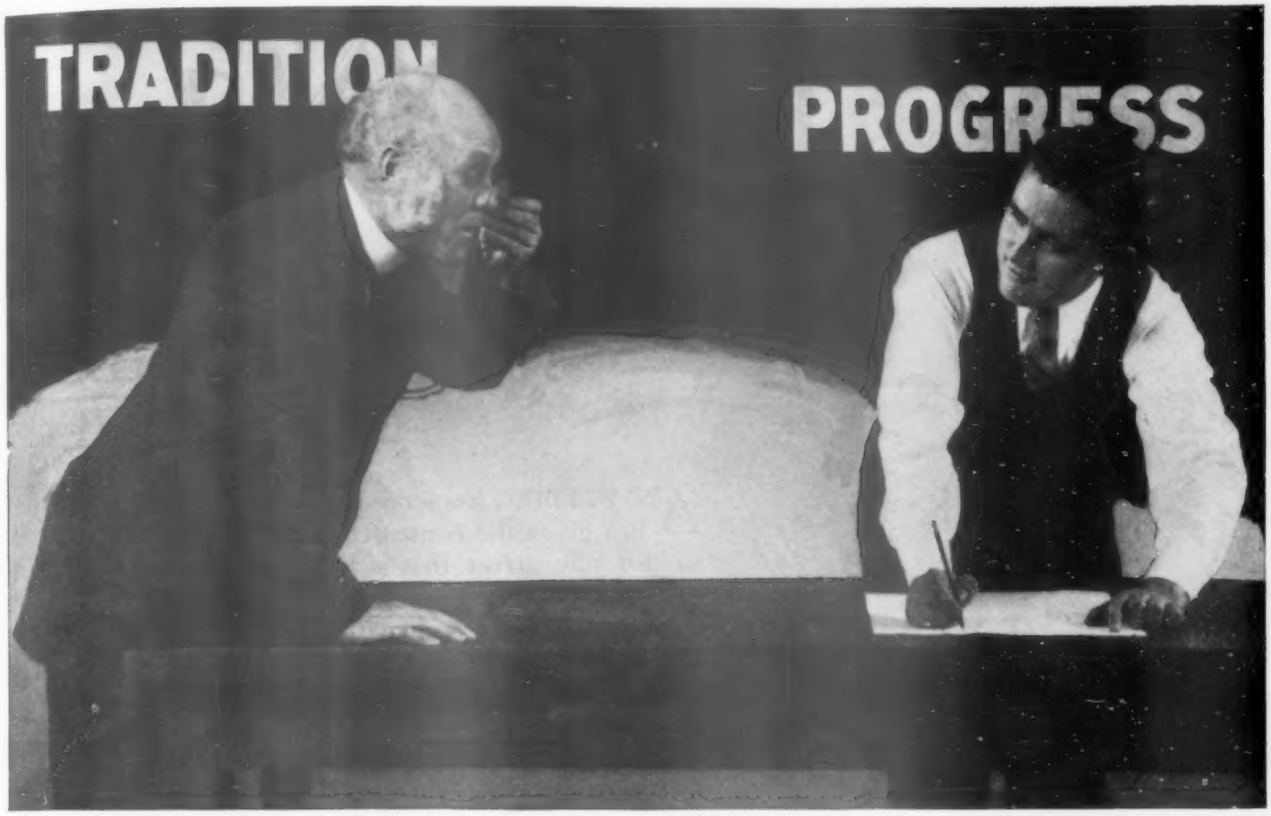
Chicago—1949 Peoples Gas Building
Cleveland—628 Keith Building
Detroit—4-240 General Motors Building
Houston—6119 Harrisburg Building
Los Angeles—1310 Santee Street
New York—30 East 42nd Street
San Francisco—114 Sansome Street
Tulsa—Exchange National Bank Building

General Offices—Kokomo, Indiana

Haynes Stellite welding rod is also available from any of the 28 District Sales Offices of Oxweld Acetylene Company

Stelliting with

HAYNES STELLITE



"Here, Lad—

I can easily see where arc welding will be okey for rough, rugged, heavy-duty machines like presses and brakes.

But for our fine precision machinery where *appearance* is of great traditional importance . . . well, arc welders *may* find a parking place in this field by 1999."

"No, Pop—

Already parked by 1929 . . . and here's proof . . . with *appearance* an outstanding feature.

This application sheet* shows how one of the substantial machine tool builders has created a special milling machine out of steel arc-welded with Lincoln 'Stable-Arc' machines.

And let me read you a few of the figures he gives us:

Cost, arc-welded, $485.00
Cost, cast construction, $1100.64
Pattern cost alone was $738.40

—almost double total welding cost. It *would* be double if this had been a production job.

Which proves again, Pop, that a parking place is the spot that another fellow moves into before you can get there."

* Copy on request

The Lincoln "Stable-Arc" Welder

— welds easier
— makes better welds
— permits greater output

because of the steady uniform arc throughout entire welding range, which is the result of:

Variable voltage design
Laminated magnetic circuit
Separately-excited generator field
Double control of welding heat
All steel construction

No other welder has all these features.

The Lincoln Electric Co., Dept. No. 27-5, Cleveland, Ohio

W-85

"Stable-Arc" LINCOLN WELDER

ARC WELDING SWEEPS ON!

AN ALL-WELDED PILE DRIVER

ARC WELDING has scored another triumph. It has given the construction industry an all-welded pile driver that is lighter yet stronger; more rigid; more portable—a structure that can be operated the year around without the expenditure of one cent for the maintenance of loose joints.

This pile driver is one of four made by the Mississippi Valley Structural Steel Company of Melrose Park, Ill., for the Walsh & Masterson Company of Chicago. Night and day, in the Chicago Loop, it pounds away—subjecting itself to terrific vibration—yet to-day, after nine months of service, it is as rigid as the day it was made.

And, again, General Electric arc-welding equipment was used to mark another milestone in the progress of arc welding.

This pile driver is 81 feet high and operates a steam hammer weighing 10,300 pounds. At no sacrifice of strength, the manufacturer showed a 15% saving in material, which greatly increased the portability of the structure.

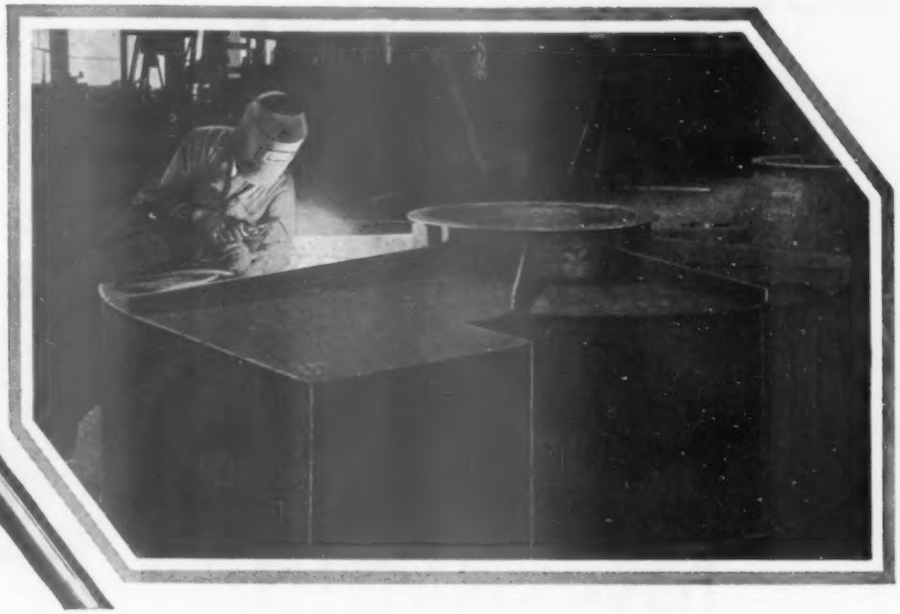
G-E welding electrodes, when used with G-E arc welders, produce strong, smooth welds at great speed.

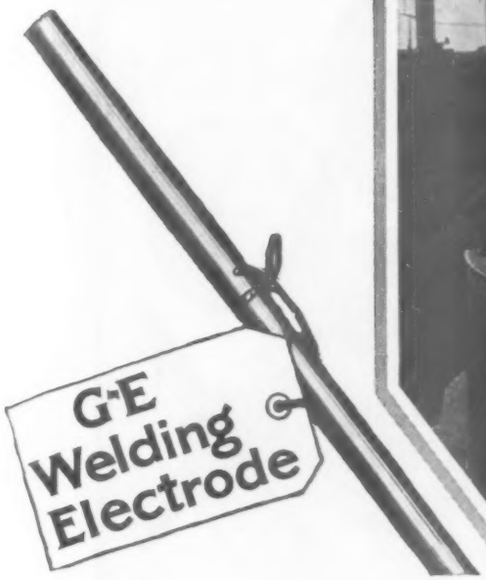
THE MORE YOU ARC WELD THE BETTER YOUR PRODUCT

530-57

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES





-*for* neat beads

Welders of exhaust-fan housings and siphon headers favor G-E Type "F" electrode because of its good penetration, rapid deposition, and arc stability.

There are other advantages which add to the natural preference of operators who have used Type "F". It can be easily manipulated and applied in any position. Header welds must be of high tensile strength and absolutely pressure-tight. Much of this work is a finish operation, requiring a non-spattering electrode and, above all, neat beads. Only an electrode of unusual excellence combines such qualities.

For prompt service or additional information as to various types of G-E electrodes, get in touch with the G-E Welding Electrode Distributor near you or write to Section E-535, Merchandise Department, General Electric Company, Bridgeport, Connecticut.

In absolute reliability of operation and over-all efficiency, G-E arc welding sets are unequalled. They are available in all sizes, all types—for either hand or automatic operation—for one or more operators.

550-512

GENERAL ELECTRIC

MERCHANDISE DEPARTMENT, BRIDGEPORT, CONNECTICUT

Must you have special tools for Regulator Repairs?

A VISE, a wrench, a screwdriver—essential equipment of even an apprentice's workbench—are all you need to take apart and reassemble the Oxweld Stem Type Oxygen or Acetylene Regulator.

Reliable
Economical
Long Lived

Typically Oxweld

These Oxweld Regulators are the last word in regulator design. They are simple—few working parts. They are rugged—no delicate mechanism to get out of order. They are dependable for any volume of gas under almost any atmospheric condition.

OXWELD

WELDING AND CUTTING APPARATUS AND SUPPLIES

OXWELD ACETYLENE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

NEW YORK Carbide and Carbon Bldg.

CHICAGO Carbide and Carbon Bldg.

SAN FRANCISCO: Adam Grant Building

You'll Get Better Results With Mueller Welding Bronze

Give it any test you choose

YOU will find in Mueller Welding Bronze Rod all the qualities you would expect to find in a first class quality bronze. It is made from our own particular mixture and always distinguished by the wording "Mueller Welding Bronze" stamped every few inches on the rod itself.

Standardize on Mueller Welding Bronze Rod—you'll never find a better one and one that always comes up to expectations for either big or little jobs. Don't take our word for it—We'll gladly send you a sample. Try it for yourself.

Mueller methods and Laboratory control and the experience gained from "three generations of brass making" insure a finished product that fuses quickly, melts at a low temperature and flows evenly and freely.

When you are in a hurry you can count on quick delivery, too.

Mueller Brass Co.
PORT HURON MICHIGAN

THREE GENERATIONS OF BRASS MAKING

THE ADVANTAGES OF
THE ROUND FILE "IMPROVED" LIGHTER
Over the "Popular" or Any Other Round-File Lighter

1. The new renewal arm of the Round File Improved Lighter has a double grasp on the renewal, thereby holding the renewal more rigidly and securely, and, by preventing wabbling, helps to prevent the spark metal from snapping out of its socket.

2. The distance from the file to the angle of lateral motion is shorter, making the leverage shorter, so that it requires less effort to push the renewal across the file and less strain on the joint between the spark metal and its socket.

3. The two points mentioned above allow with safety the use of a longer piece of spark metal. The new IMPROVED Lighter has been provided with a spark metal that is approximately 30% longer than the spark metal used in the POPULAR Lighter, giving approximately 40% more ignitions per renewal, or approximately 5600 ignitions per renewal on the Round File IMPROVED Lighter as against 4000 on the Round File POPULAR Lighter. No more of the renewal has to be buried inside the socket on the longer piece of spark metal than on the shorter piece. This gives the IMPROVED Lighter a larger percentage of economy in the use of spark metal.

4. The new style of Renewal, not having any thread, will do away with the stripping of threads, which sometimes makes it difficult or impossible to put an additional Renewal on the Lighter.

5. The new Renewal also will permit the use later on of a more brittle metal for the bushing holding the renewal, for instance, a magnesium renewal bushing running the full length of the spark metal. Magnesium, being brittle, can be filed off about as readily as the spark metal itself without making the file hang as the brass bushing does, and therefore can be used the full length, thereby preserving the spark metal from oxidising on its side, and thereby preserving the renewal almost indefinitely when not in use, and also enabling the renewal to be used clear down beyond the point where the bushing and the spark metal meet, this part of the spark metal at the present time having to be thrown away because the brass bushing hangs the file.

6. The plating of the Round File Improved Lighter is cadmium, which is rust-proof, while nickel or tin (the latter being what is generally used on cheap lighters) are not rust-proof at all. Points of the teeth rusting off make the file dull.

7. The Round File Improved Lighter has a double bearing for the forefinger of the right hand, making control of the Lighter more certain. The wires on the arm, which hold the Renewal, are so placed in relation to each other as to force a correct course of the renewal across the file, thereby taking up the inaccuracy of the human hand, some hands being disposed to push the renewal away from the file, and some too much into the file, in using the Lighter.

8. The wire arms of the new Lighter are of slightly smaller diameter than the POPULAR Lighter, allowing an easier and quicker stroke.

9. The IMPROVED Lighter has a hood, which holds a pocket of gas down to the point of ignition, the wings of the hood being parallel to the bottom of the file. At the same time, this new hood, and the position of its wings, provide a raceway for the renewal to travel in, across the file, keeping the arms of the Lighter from getting out of correct alignment. On the Round File Popular frequently the renewal arm would push the renewal beyond the file or not as far as the file wearing off one corner of the renewal and interfering with the efficiency of its work.

10. The hood of the new Lighter is also easily disassembled. As there is getting to be a market for files and other parts as well as for renewals, this allows shop men to reassemble them more easily than when they have to use pliers to bend a piece of steel, sometimes breaking it off.

11. An improvement not yet completely worked out in practice, though worked out in theory and already demonstrated that it can be done, is a means of automatically turning the file so that a new surface is always present at every ignition, the file being turned very slightly every time the Renewal travels across the file.

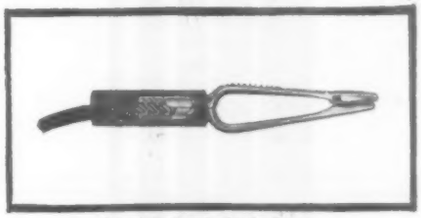
SAFETY GAS LIGHTER CO.

56 Sanderson Avenue, LYNN, MASS., U. S. A.

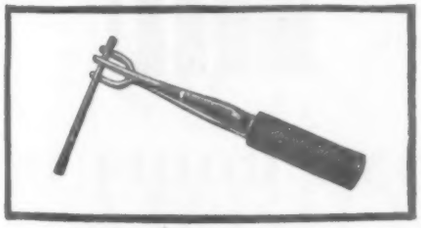
The New STOODY ELECTRODE HOLDER

PRICE
without lead
$4.00

Showing simplicity, yet rigidity of construction



Lead is firmly locked in



Welding rod easily inserted. Perfect contact at all times

THE new STOODY ELECTRODE HOLDER presents the welder with a tool, that, for convenience, speed, dependability and performance has never been equalled.

It is non-corrosive, non-tempered, affords ***perfect*** contact at all times, is marvelously simple to operate and is of such rigid construction that it offers years and years of profitable, vexation-free operation.

Even the previous STOODY ELECTRODE HOLDER was a highly advanced tool, but this ***new*** model, perfected after exhaustive experimentation and research offers something, heretofore unobtainable at any price . . . and, the price of this newer, more efficient tool is but $4.00

Order direct, or write for further information

STOODY COMPANY

Manufacturers of WELDING ROD • ALLOY STEELS • EQUIPMENT

Whittier, California

For all welding operations

• • • National

Welding Carbon

Products

WHETHER you do gas or arc welding, National Welding Carbon Products are at your service. Not only are they available for use in making molds, cores and dams, but as electrodes they are playing a vital part in the development of the arc processes. Using modern methods and materials it is now possible to weld with a minimum of heating of adjacent parts, and produce welds that are not only stronger than riveted joints, but actually stronger than the shapes themselves.

Our advice has been of great assistance to manufacturers, contractors and engineers. May we help you realize the economies of modern welding?

Write for list of our distributors

NATIONAL CARBON COMPANY, INC.
Carbon Sales Division
Cleveland, Ohio

Unit of Union Carbide UCC *and Carbon Corporation*

Branch sales offices are located in
New York, N.Y. Pittsburgh, Pa. Birmingham, Ala.
Chicago, Ill. San Francisco, Cal.

NATIONAL WELDING CARBON PRODUCTS

BLOCKS
RODS
PASTE
FLOUR
ELECTRODES

The Greatest Return on Your Investment

ONLY carbide which conforms to the most rigid standards of quality and uniformity is shipped to Union Carbide users.

As a result of these exacting standards, Union Carbide yields the most gas per pound—the greatest return on your carbide investment.

UNION CARBIDE SALES COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

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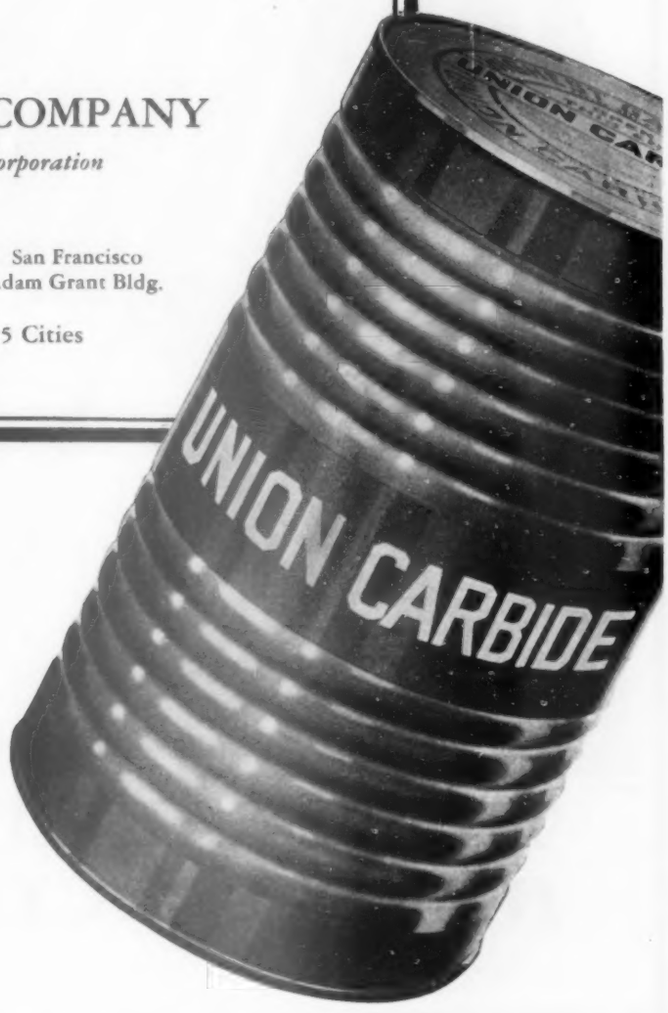
Carbide and Carbon Bldg.

Chicago
Peoples Gas Bldg.

San Francisco
Adam Grant Bldg.

Union Carbide Warehouses in 235 Cities



UNION CARBIDE

Announcing
a
NEW
"KORO"
Coated
Electrode

THE IDEAL ELECTRODE FOR
HAND ELECTRIC WELDING

FABRICATION

The dependability of machine bases and machine parts welded with KORO electrodes is assured by the fine welding qualities of the wire and the ease of fusing it with the base metal.

STRUCTURAL

The new KORO electrode is especially recommended for structural steel welding. It is an aid to production both in shop welding of structural units and erection work in the field.

• • •

Meeting every hand welding need

THE new KORO Hand Welding Electrode is made possible by newly installed equipment for uniform coating. This wire is smooth flowing and easy to work; but not too fast to allow the full penetration which is demanded when welding for strength.

KORO CORPORATION
WAUKEGAN, ILLINOIS

• • •

Write for booklet describing the complete KORO line of wire for gas and electric welding

OVERHEAD

Overhead welding is one of the most exacting jobs the arc welder has to handle. Give him a supply of KORO electrodes and watch the difference in the performance.

{ONE OF A SERIES SHOWING AMERICAN TRANSFORMERS IN MANY DIVERSIFIED INDUSTRIES}

WELDING SPEEDS PRODUCTION!

WELDING in the automobile field is an acknowledged success. Leading manufacturers attribute at least two major improvements directly to its introduction in their field:

1. Increased production (with increased profits)
2. Stronger, more rigid chassis, frames and bodies.

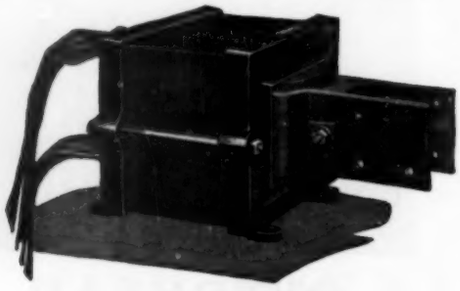
The welding equipment for this purpose must be chosen with care. Of special importance is the transformer used, for upon its efficient performance depends the strength of the weld.

Three factors should be given first consideration when choosing the transformer:

1. Efficiency— (wide range of voltage with a dependable control board)
2. Reliability—(24 hour service, without interruption, if necessary)
3. Economy — (long life with a minimum of repairs)

American Transformers are built to meet the individual requirements of welding machines for spot, seam, arc, flash and other welding methods. Bulletin 1040-W gives complete description of type CF which is used mainly for spot welding.

{There is an American Transformer for every industrial service. Let our engineers advise you on *your* problem—no obligation, of course.}



American Transformer
TYPE CF for welding machines

AMERICAN TRANSFORMER COMPANY

178 EMMET STREET NEWARK, N. J.

Representatives

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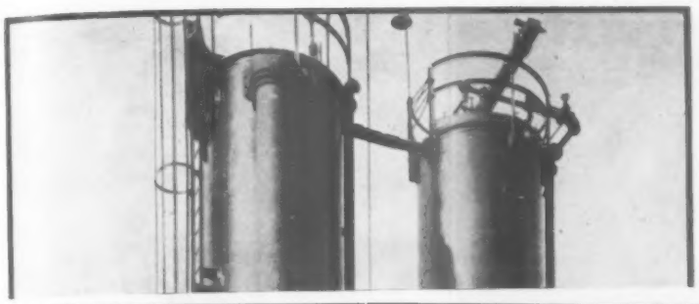
682 Mission Street

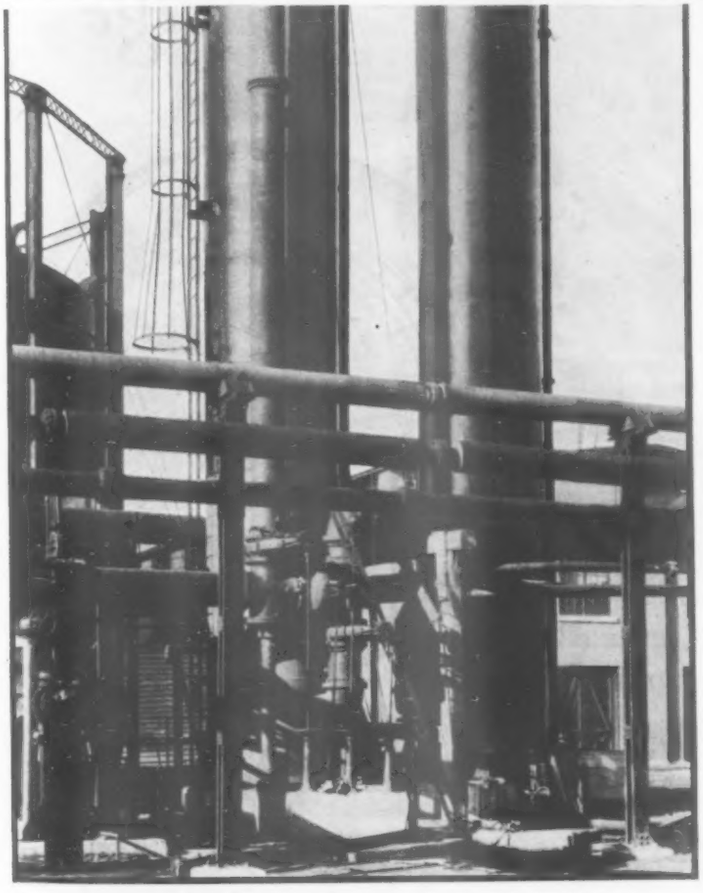
St. Louis, Mo.
J. W. Jones
432 Pennant Building

AMERICAN TRANSFORMER



Weldability and rust-resistance—these are the qualities that prompted engineers of the Hamilton By-Products Coke Co., Hamilton, Ontario, to choose ARMCO Ingot Iron for the huge cooling towers shown above. Every seam in the 60 foot by 7 foot towers was electrically welded for strength and permanence. Manufactured by Waterous, Ltd., Brantford, Ontario. Contracting engineer, A. T. Leavitt, of Hamilton, Ontario.

Why welders everywhere prefer ARMCO Ingot Iron



WELDING Shops, Engineers, the Welding Departments of great industries — these are the discriminating users who prefer to work with ARMCO Ingot Iron.

One and all, they find this pure iron a slagless, clean, uniform metal. And so it makes for clean, dense welds, as strong as the surrounding metal.

A manufacturer of septic tanks writes: "ARMCO Ingot Iron is much easier worked than steel, both in forming and welding. It is much softer and absolutely uniform. We employ both electric arc welding and gas welding, and we have never had any difficulty welding ARMCO Ingot Iron by either of these processes."

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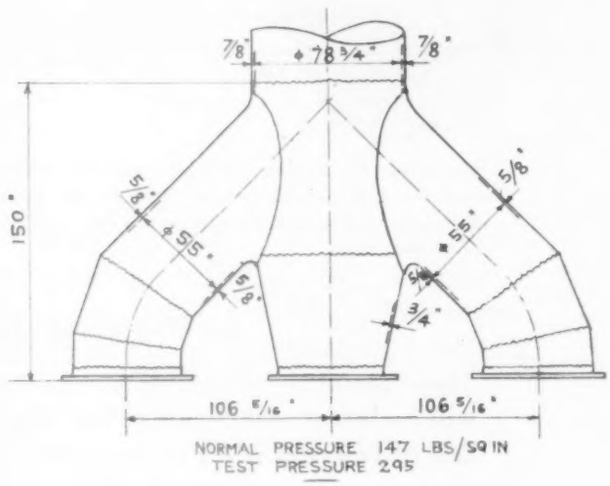

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6" Lateral
6" Round End
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8" Rt. Angle Ell
8" Lateral
8" Round End
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10" Lateral
10" Round End
10" Tee
10" Y
10" Split Bull Plug
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12" 45° Ell
12" Rt. Angle Ell
12" Lateral
12" Round End
12" Tee
12" Y
12" Split Bull Plug
4x3 Tee
6x3 Tee
6x4 Tee
8x6 Lateral
8x3 Tee
8x4 Tee
12x3 Swedge Nipples
12x4 Swedge Nipples
12x6 Swedge Nipples
12x8 Swedge Nipples
12x10 Swedge Nipples
10x3 Swedge Nipples
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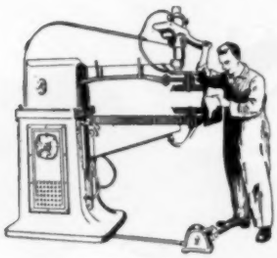

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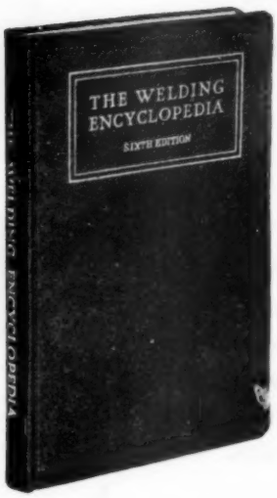

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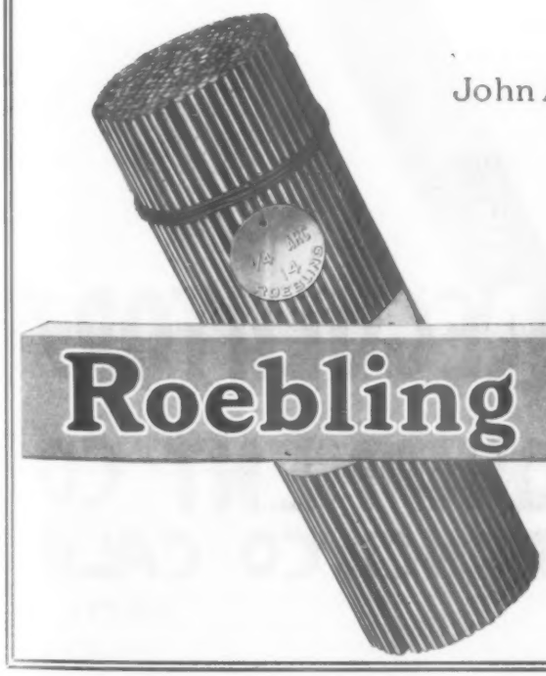

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EDITORIAL

Should Colleges Teach Welding?

THAT question can only be answered by facts which would tend to show that the welding process is an essential phase of the majority of the types of work in which an engineer may engage. Those in close touch with the welding industry know that welding is used in one way or another in connection with all types of work handled by engineers. They know from constant experience that the use of welding is growing rapidly in all industries using piping; in power plants, in heating and ventilating, and in the construction and repair of long gas, oil, and water lines. They know that welding is also gaining a foothold in the structural steel field. In a number of the larger cities the structural steel workers' unions are sending members to be taught arc welding by the experienced welders in the city. The same is true in the case of some of the steamfitters' and plumbers' unions. The members of the unions in these two extensive fields of industry, structural steel and piping, are beginning to see that it will pay them to learn to use this new tool if they wish to maintain and improve their positions. If such is the tendency of the workmen, it certainly should be necessary for the engineer to know something of the use of this process. It is difficult to obtain actual figures as to the extent of the use of welding in any one given field of industry. In most cases it is such a rapidly developing process that it is nearly impossible to keep in touch with its growth. But recently, a rather general survey was made of 87 manufacturing plants producing all types of metal products, and of this number only ten were found to be without their own welding equipment. In other words 88.5 per cent of all the manufacturing plants visited used welding to some extent. Over one-half of them were equipped with both oxy-acetylene and electric-arc welding outfits. Both production and repair welding was being done by over 60 per cent of them, the remainder using the process for up-keep and repair. In fact, the using of welding in maintenance is practically an accepted thing in all industries. The use of the process in production is limited of course by a number of factors such as; the material of which the product is made, the design of the metal product, whether there is an economic advantage in welding, whether welding in the specific case gives the more durable joint, whether material can be saved through the use of welding, whether time can be saved in the production, and many other similar problems. All these problems come before the engineers in the majority of the manufacturing plants visited. Taking these figures given above as somewhat typical of industry all over the country; they would seem to prove the advisability of having at least one general course on the welding process which the majority of engineering students should take.

Progress in Simplification

AGAIN of 14 simplified practice recommendations and a 52 per cent gain in support from trade associations and firms during the first quarter of the present year are two outstanding facts in a report covering the activities of the Commercial Standards group of the Bureau of Standards for the first three months of 1929, which point to the progress which has been made in the cooperative effort to eliminate waste through a reduction in the manufacture of superfluous varieties of staple articles. During the first quarter of this year seven simplified practice recommendations were reviewed by their respective planning committees to ascertain the average degree of support accorded each, which amounted to nearly 80 per cent. The work of this group which has called for an enormous volume of correspondence and statistical work has met with some opposition from those who had misgivings as to how their interest would be affected if standardization in manufacture were carried to an extreme. It is very evident though that the majority of manufacturers and merchandisers recognize the benefits which a rational amount of standardization will produce. So the work of this group continues to accumulate support.

Troublesome Problems Not Limited to Welding

A RECENT article in one of the leading engineering business papers bears the title "Today's Most Troublesome Construction Problem." That same title found in this magazine would lead the reader to believe that it was a discussion concerning the problems arising through the application of welding to steel structures. In reality the title applied to an article on the basic principles of concrete making. Each separate process has its own problems. The far-seeing engineers in every industry are continually working to find the best basic principles of their respective processes. At the same time they are going ahead in their particular industries allowing a margin of safety for those unknown factors which they are still striving to reach. This is admittedly true in the use of concrete in construction. You do not find the architect and the engineer refusing to use concrete because there are certain unknown factors which have not as yet been fully agreed upon. The same attitude should be applied to the use of welding. There are certain known factors in this process as there are in concrete making. From these known factors the designer and engineer can proceed to designate the use of welding. Then it follows that the more it is sanely used, the more will be found out about it, and so it will develop, being built on the solid foundation of actual experience.

A Large Scale Research Program

TWO new research projects, one relating to alloys of iron and embracing all forms of iron and steel and the other involving the materials, manufacture, and use of wire ropes, are among the new activities of the engineering foundation mentioned in its recent Annual Report. This interesting document points out that during the centuries in which man has used great quantities of iron and steel there has been a great accumulation of literature on this subject which should be carefully searched and classified so that the best facts can be made accessible to the thousands of men who need more facts about iron and its combinations with other substances. The American Institute of Mining and Metallurgical Engineers recently called a conference of 40 representatives of 29 corporations and other organizations for the purpose of mapping out a plan for cooperative research in alloys or irons. Definite steps for putting the plan into operation will be taken as soon as funds are available. This piece of research alone will benefit producers of iron and steels, producers of alloys and alloying elements, the railroads, manufacturers and users of automobile trucks, tractors and airplanes, and a number of other important industries. The work of the Engineering Foundation has gained for it considerable financial support in the past and the Foundation is now in a fair way to receive some very large endowments which will make possible a continuation of this great research program which affects all industries.

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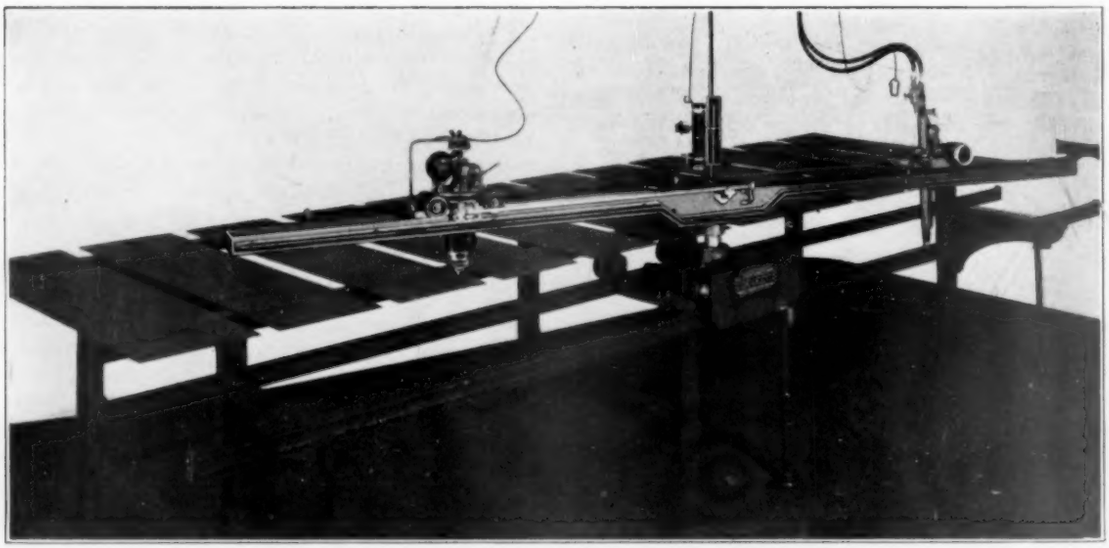
COMMERCIAL FACTS AND FIGURES:

STEEL SHAPES STRUCTURED TOGETHER BY WELDING CAN SAVE UP TO 60% IN COST. THEY USUALLY WEIGH ONLY ONE-HALF AND ARE LESS SUBJECTED TO BREAKAGE. THERE IS NO DANGER OF JUNKING FOR BLOW-HOLES OR OTHER DEFECTS AS WITH CASTINGS. SHAPES ARE CUT TO AT LEAST $\frac{1}{64}$" EXACT, WHICH MEANS VERY LITTLE FINISHING—IF ANY. THUS, COST OF PRODUCTION IS REDUCED SUBSTANTIALLY AND SO ARE THE UNPRODUCTIVE COSTS. THE STOCK CARRIED IS SIMPLE AND NOT BULKY—PLATES INSTEAD OF INNUMERABLE CASTINGS. LESS PATTERNS AND MOLDS TO CARRY AND TO MAINTAIN, LESS FLOOR SPACE, LESS HELP TO KEEP AND MAINTAIN STOCK, LESS CAPITAL TIED UP IN STOCK, LESS INTEREST.

TO BE CONTINUED.



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Detailing of Welded Steel Buildings*

How the Problem Was Solved in the Drawing Room When Welding Was Specified Instead of Riveting on a Large Steel Building

By E. C. Brown†

NEW departures in practically every line of endeavor have inevitably met with resistance, particularly from those who are engaged in the line of work in which the departure is made and who prefer to adhere to former methods.

When the first wrought iron nail was introduced the "doubting Thomases" implored the people not to permit their use and the "powers that were" to legislate against the use of the iron nail in any structure, the plea being,—first, that the nail was not reliable except in part, when it was possible to clinch; secondly, because the elements would soon cause its deterioration and thirdly, and by no means the least objection, the lightning would surely be drawn by these "iron pegs" and so cause destruction of life and limb; further, the old "wooden key" or "trennel" would always suffice.

Even as late as the early eighties, this "lightning bogy" was with us when steel frame structures first began to appear.

Another objection raised was the allegation that steel was too brittle and even after steel was introduced for main members, a good many of us can still remember the iron rivets, and it took a long time for the steel rivet to become generally acceptable.

We are now beginning to face the welded structure, which is most essentially a child of the present day and this welded structure is traveling the same thorny path of its immediate predecessor, but its advocates have the same patient determination and spirit, which spells the one word that applies to this form of structure—namely, SUCCESS—that overcame the obstacles mentioned above which faced other forms of metallic construction.

The details of this structure were prepared by the writer from general plans by Bernard Prack. The steel was furnished by the Jones & Laughlin Steel Corporation and the field welding and erection was done by Minnotte Brothers Company.

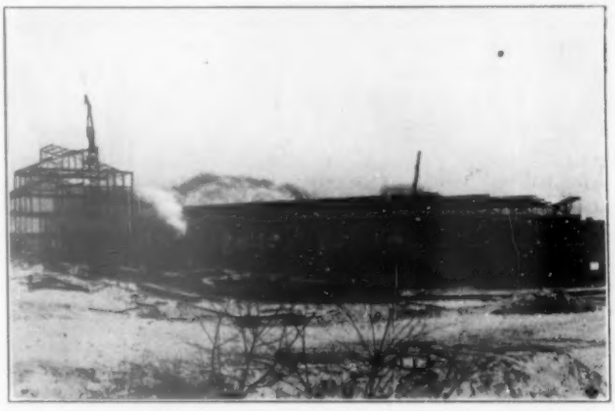
In the detailing of this work there were many points developed, some of which may be interesting. The main material was ordered, cut to length and shipped direct from the mill to the job. This material had the usual mill variations and was marked with an item number on each piece for identification in the field, and in addition, the detailed material that had shop work, such as base plates, base angles and connections were also given an assembly mark.

The fitters on the job assembled and clamped this material together from the Shop Bills and Detail Drawings, after which the ground welding was done. Column slabs, where light, were welded to the column shaft prior to erection. The heavier slabs were welded to the columns after erection. For the latter type clips were ground welded to the columns to take the anchor bolts so that the columns could be held in position without waiting for the welding of shafts to the base slabs.

The beams were detailed with a connecting angle welded to the top flange at each end so as to maintain an accurate overall length and to insure the proper spacing of the columns to which they connect. A seat angle was welded on the columns to take the reaction from these beams and after the beams were placed the beams were welded to the seat angle and the top connecting angle welded to the column, thereby making a stiff connection.

The bottom chord struts between the trusses were detailed with a small plate or bar, welded to the web of the strut at each end—this plate or bar being notched so that it would drop over the vertical leg of the angles constituting the bottom chord of the trusses, this holding it in place until field welding could be done.

The use of welded connections simplified these details as there were no gauge lines for holes and if necessary for a beam to be set off center it could readily be done using the same detail as if it had been required on the center of the column. In riveted work seat angles vary every time a gauge is changed, adding considerable to the complications of detailing.



Welded Structure Referred to in Mr. Brown's Paper.

As you have noticed, there are very few holes in this work except for the connection of what may be called "companion materials" and the only bolts used on the job for connecting steel to steel were for fastening purlins to trusses and window struts to columns.

In all, there are four buildings embraced in this operation. Building No. 1 is 60 ft. wide by 140 ft. long; has three floors and roof with an offset 20 ft. by 75 ft. of the same height as the main building. Building No. 2 is 60 ft. wide by 300 ft. long with a four story offset 20 ft. by 40 ft. Building No. 3 is 100 ft. wide by 460 ft. long, the two end bays of which compose the office building,—this Office Building being two stories high. Building No. 4 is 57 ft. wide by 132 ft. long and has a five ton crane runway.

With the exception of the offsets and the Office Building, the roof construction consists of trusses with monitors and channel purlins, the purlins of the Office Building being the J & L Junior Beams, as is also the case with the offset roofs. A walkway runs the full length of the inside of all monitors for the use of window cleaners. The walls are of brick and windows have steel sash—the trusses being from twenty feet to fifty-five feet above the ground level. Spandrel beams in general consist of beams with plates to carry brickwork and with window angles.

The total tonnage for all the buildings is approximately eight hundred seventy-five tons.

The instructions received at the time of undertaking this detailing were as follows: There was to be no punching of

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*Presented before the Pittsburgh Division of the American Welding Society, January 30, 1929.

†Jones & Laughlin Steel Corporation.

main material except crane girders for rail clips, window supports for sash and for purlins.

No bolts were to be used except where erection would be exceptionally difficult and for purlin connections.

No welding was to be done in the shop but all welding was to be done at the site.

No over-head welding was to be done.

All material to be ordered shipped direct from the mill to site, unless punched, cut or milled. All punching, cutting and milling was to be done at the shop.

The details of beams framing to columns and girders were to be so made that they would automatically space the columns and could be easily clamped into position, regardless of any cutting variation.

Erection Diagrams were to show position of beams, etc., in their relation to column centers and floor lines.

These instructions were adhered to in the detailing of this work.

It is needless to say that placing a job of this size and character in a Drafting Room with the above instructions gave us some new problems to solve, as there were no leads available except a small amount of literature on Welded Structures and which described the various tests and the precedents set by riveted work—and while good, were by no means always applicable.

The natural tendency of structural draftsmen, by training and years of experience, is to visualize all connections and joints as riveted and it was necessary to overcome this tendency to a certain extent, for while the general conditions were similar to riveted work, the immediate requirements made it necessary to develop from these general conditions a welded job that would be satisfactory.

The first actual work done in the Drawing Room was the ordering of main material—the major problem here being to decide whether the material should be ordered shipped to the Shop or direct to the site.

In writing the Order Bill the material was noted on the margin as to where it was to go and an item number was assigned to all material for identification, this item number being painted on all pieces marked as "shipped to the site," as this was the only readily available means of identification that could be used. There was a further use for this item number, which will be explained later.

In preparing the details, the fact that all welding was to be done at the site made it necessary to devise a system whereby all members of any particular piece could be identified and assembled. This was no small task, as can be gathered from the fact that the number of pieces to be handled was about twenty-six thousand and which varied from bars 2x¼x3 inches up to 24-inch beams 55 feet long.

Except for the trusses, all details were made on sketch sheets measuring 12x24 inches and the component parts of each piece, be it a beam, column or truss, that was fabricated in the Shop was given an assembly mark, which mark was followed by the sheet or drawing number that was used as a shipping mark and listed alongside of the detailed sketch as Shop material, and the parts that had been shipped direct from the Mill were listed as "Field material" and carried the item numbers previously mentioned as appearing on the Mill orders. In this way it was easy for the Drafting Room, Shop and the Field man to tell at a glance from the detail drawings from what source the material would come.

The types of details used were seat angles and top clips, so far as possible, and where this was not sufficient a bar was welded to the end of the beam, which in turn was welded to the supporting member, making what in riveted work would be called a "web hitch." Where two beams of the same depth framed together, the web of the connecting beam had a bar welded to the web which in turn was welded to the web of the header beam and a bar was welded to bottom flange of main beams, extending out about two inches, for a landing seat—but where the header beam was deeper a seat angle was welded at the proper height. Spandrel sections and other light compound members were fastened together with tack welds, about 12-inch centers—these tack welds being about one inch long.

The detailing of the trusses on this work required considerable study as the chords were composed of two angles and both angles must take their share of all stresses. To do this, the web members had to be connected to both angles to properly distribute their load. Gusset plates were used only at the heels of the trusses and a small reinforcing plate was used at the peak. Clips for connecting purlins were welded to the rafters,—the outstanding legs of these clips being punched to receive purlins. The knee braces were punched with one hole at each end to receive drift pins for lining up the structure. Continuity for floor beams and purlins was obtained by continuity plates or bars on the top flanges over supporting members and welding in of bottom flanges to the supporting members to take the corresponding compression.

In specifying the welding, ¼-inch fillets were specified on all material ¼-inch thick and ⅜-inch fillets were used elsewhere with a few exceptions where heavier welds were required.

Great care was taken to properly distribute the welds over the connections so as to insure rigidity to the welded connection when completed.

In assembling the trusses the bottom chords and rafters were assembled and welded separately—these chords and rafters being afterwards put together in jigs so as to be held in proper position, after which the web members were put in place and the entire truss, including monitor frame, welded up into one piece. When this was done, the truss was taken off the welding skids and placed to one side until the time came to put it in the building.

In giving dimensions for these trusses, all dimensions were given to the backs of angles instead of to gauge lines as is customary on riveted work, the reason being that this gave the fitter a definite point to which to work and in the assembly, clamps were used for holding the material together preparatory to welding—and there was developed great ingenuity, as in spite of all efforts, many details were found that would be difficult to hold with the ordinary commercial clamp that is available in the market.

MICHIGAN STATE COLLEGE ISSUES BULLETIN ON ARC WELDING RESEARCH

Bulletin No. 21 of the Michigan Engineering Experimental Station, published by the Michigan State College of Agriculture and Applied Science, at East Lansing, Michigan, is entitled "The Micro Structure of Electric Arc Welds in Structural Steel." The joint authors of the paper are H. L. Publow and F. L. Reynolds, of the Department of Chemistry. This bulletin describes a number of welds made on structural steel members which were examined both for macro and micro structure. All of the welds were made with a modern welding machine and with the same electrode material, but by different operators. A large number of photographs were taken of typical welds, including both good welds and poor ones. These prove that skilled operators are necessary in making a safe joint and that a properly made weld shows perfect fusion between the plate steel and the deposit metal. It is intended that if a rupture occurs in a good weld it will not take place at the bond between the metals but either in the deposited metal or in the plate metal. Although considerable mention is made of the probability of imperfections in the weld metal, one of the conclusions given is that material when welded properly is as strong as many rolled sections.

Recent Developments in Brass Rods*

Welding Rods of New Composition Show Better Results in All Applications and Seem to Open up New Fields to This Process

By A. R. Lytle†

BRASS or bronze welding is a widely employed method of joining dissimilar metals and alloys, repairing or constructing cast iron or steel structures, taking up wear on worn parts and welding various copper alloys.

For each of these applications the use of bronze welding is based upon certain properties of the bronze weld metal

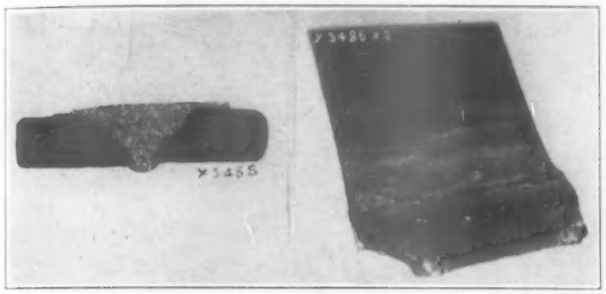


Figure 1. (Left) Etched Section Through Weld in Machine Brass Showing the Soundness and Good Quality of the Weld Metal. Welded with Silicon Bronze. Natural Size. Figure 2. (Right) Fracture of Weld in Machine Brass. Fracture Passes Partly Through the Weld Metal and Partly Through the Base Metal. Weld Metal Is on the Upper Half of the Fracture. Natural Size.

such as its ability to alloy with cast iron and steel at temperatures below the melting points of these two materials, the high strength and ductility of the joint obtained, its resistance to wear and in some instances its corrosion resistance. Therefore, in discussing brass welding rods, it is necessary to point out how the rod meets the requirements in each specific type of welding. For convenience, the subject will be discussed in two parts, namely, welding copper alloys and general bronze welding.

Welding of Brass Alloys

Although the terms brass and bronze include a large variety of compositions, a discussion of their welding characteristics need not be detailed, principally because these welding qualities are not as dependent upon small variations in the usual alloying elements as are the physical properties. The brasses may, however, be divided into two types from a welding standpoint. Of these, the alloys of the 60 copper, 40 zinc type are characterized by a melting point that is almost as sharp as that of a commercially pure metal. To the welder this means that the metal will melt rapidly and uniformly, and with the minimum of boiling, and that it will freeze quickly thereby permitting easy control of the weld metal. One of the principal reasons for the universal use of alloys of this type for the so-called bronze welding is that they retain sufficient strength while just below the melting point to avoid cracking due to shrinkage stresses. But as the oxidation of zinc during welding is not entirely prevented, the evolution of zinc oxide fumes is quite rapid and the welds tend to be somewhat unsound. This unsoundness will be found by remelting the weld or by sectioning it.

The second type of brass from a welding quality standpoint includes pactically all the high copper alloys. It is characterized by a high melting point which makes welding more difficult, as it promotes the oxidation of zinc. This may occur so rapidly that it is difficult to bring the metal itself to the fusion point, due to the rapidly rising melting point resulting from the removal of zinc from the alloy. Welds in this material are difficult to obtain and are quite porous.

As the future uses of brass and bronze as fabricated materials will be roughly proportional to the ease with which sound welds can be produced, it is necessary to have available a brass welding rod that will produce sound welds and prevent the oxidation of zinc. This twofold purpose has been accomplished by the addition of the element silicon in amounts less than one-half of one per cent. The improvement in welding quality due to this small addition of silicon is so great that the metal acts as an entirely different alloy. The evolution of zinc oxide fumes is practically eliminated. No boiling occurs during either melting or freezing. The metal acts as a uniform alloy with a well defined melting point and maintains a clear, creamy consistency while molten. The solidified metal is free from porosity either near the base metal or in the weld metal itself.

The elimination of zinc oxide fuming is due partly to the preferential oxidation of the silicon before the zinc, but also

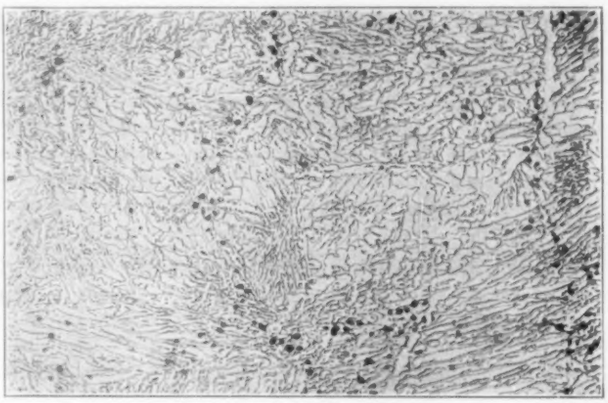


Figure 3. Photomicrograph Showing the Distribution of Lead Next to the Weld in Leaded Brass. Fracture in Tension Test Passed Through This Zone. In the Unwelded Piece the Load Was Uniformly Distributed. 100X.

TABLE I

Base Metal	Ultimate Strength Lbs. Sq. In.	Remarks	Fracture
⅛" Machine Brass	44,200	Reinforced	Base Metal
⅛" Machine Brass	44,500	Not Reinforced	Base Metal
⅜" Machine Brass	35,000	Not Reinforced	Base Metal
2" Muntz Metal	39,000	Reinforced	Fracture occurred in base metal parallel to the weld scarf. This was due to the segregation of lead.

*Paper read before the 29th Annual Convention of the International Acetylene Association, Chicago, November 16, 1928.

†Union Carbide and Carbon Research Laboratories, Inc., Long Island City, N. Y.

partly to the protection offered by a very thin film of slag that is formed on the molten metal. Probably the presence of silicon also prevents boiling during melting or freezing as it has the property of making gases soluble in metals so that they are not given off during a change in state as in freezing.

In order to show the good quality welds produced by this

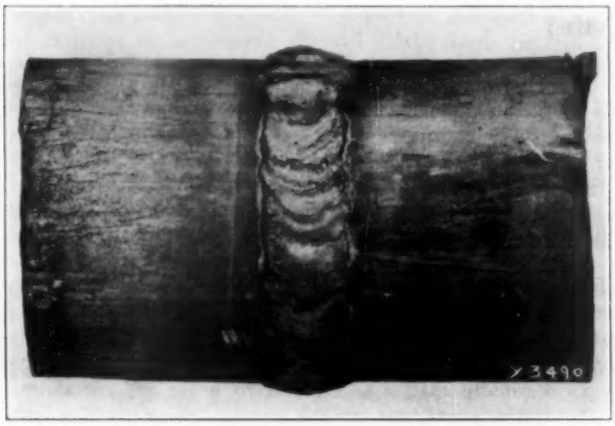


Figure 4. A Weld in Brass Pipe Using a Silicon Bronze Welding Rod of the Same Chemical Composition. Natural Size.

silicon brass composition, the following table and accompanying photographs have been prepared.

With increased thickness of base metal it becomes almost necessary to use the silicon alloy, as only mediocre welds can be obtained with commercial bronze welding rods. The evolution of zinc oxide fumes in heavy welding is so great that precautions in the nature of masks and ventilating equipment are necessary to protect the operators. Also, the change in chemical composition due to the removal of the zinc may be so great as to alter the physical properties of the weld metal upon which the design has been based. In all cases it will be noted that the fracture of the specimen welded with silicon bronze was in the base metal. This is as it should be, for due to the freedom from blowholes, the full section of the weld metal was effective in resisting the tension stress.

The welds in 2 in. thick Muntz metal brought out very clearly the detrimental effect of lead in brass to be welded. Lead has long been known to be objectionable in brasses and bronzes to be welded because it boils out of the metal and collects on the scarf. As it does not dissolve in the weld metal nor become uniformly distributed, the quality of the weld is poor. Fig 3 shows what occurs in the base metal containing 0.75 per cent lead. This lead has segregated around the grain boundaries next to the weld, forming in a clearly outlined weak zone through which failure occurred. It was due to this segregation that higher strength was not obtained in these specimens.

One of the outstanding applications for which brass is being advocated is in the plumbing systems of buildings. The great value of the alloy for this use lies in its resistance to corrosion in water. However, for true corrosion resistance, it is necessary to use the copper zinc alloys of the alpha type, that is, consisting of only one constiuent. All these alloys fall into the second type of alloys described above and consequently have been considered to be of poor welding characteristics.

As will be shown in the table below, and as is generally conceded, joints made with unions are of relatively low strength and unless carefully made and tested may leak. These precautions add to the cost of the joint. Some success has been obtained by welding these joints using the common bronze rods, but it must be remembered that all these alloys are composed of two constituents, the alpha and the beta, and hence are more rapidly corroded in water than the pipe material which is composed of alpha grains only. The ideal method of joining the alloys would be by using a welding rod of the same composition as the pipe metal and thereby creating as little a variation between the pipe and weld metals as possible.

This can be accomplished very easily by adding a small amount of silicon to the alloy for welding rod. As soon as this rod is added to the scarf during welding, the boiling and fuming stop, and while with ordinary rods the molten metal is thin and difficult to control, the presence of silicon produces a creamy appearing molten metal that is readily cotrolled by the torch flame.

Figure 5. Photomicrograph of Brass Pipe Structure Showing That It Is Composed of One Type of Crystals Only. Termed Alpha Brass. 100X.

TABLE II

Fracture	Strength Ultimate Lbs. Sq. In.	Elongatnon Per Cent in 2 In.
Pipe Welded. Average of 4	34,500	30.0
Shear along threads Mechanical Union. Average of 3	20,900	.....

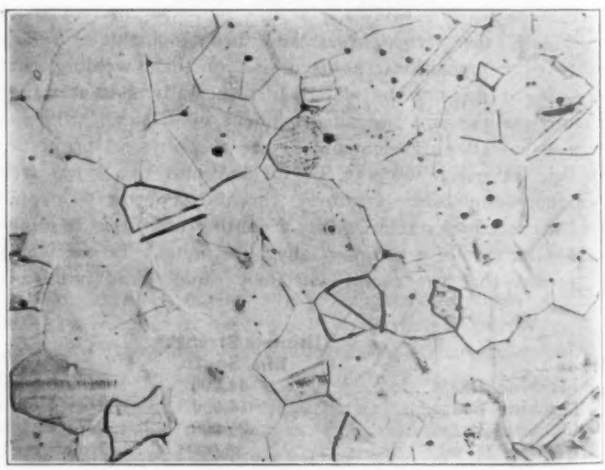


Figure 6. Photomicrograph of Weld Metal Structure in Pipe Specimen Showing That It Is Composed of Alpha Crystals Only. This Metal Is Sound and Uniform in Composition. 100X.

The accompanying photographs show the uniformity in structural characteristics and soundness of welds obtained in this alpha or so-called admiralty brass pipe when the silicon welding rod is used, and also the discontinuous metal composition when one of the common welding rods is used. The tensile results in the following table show clearly that the welds are stronger than the pipe.

Brass pipe welding is but one of many fields in which the weldability of the alloy will exert a strong influence on the extent to which the alloy is employed. In a great number of cases, it will serve the purpose with perfect satisfaction to use commercial bronze welding rods which contain silicon, but for special purposes recourse should be had to welding

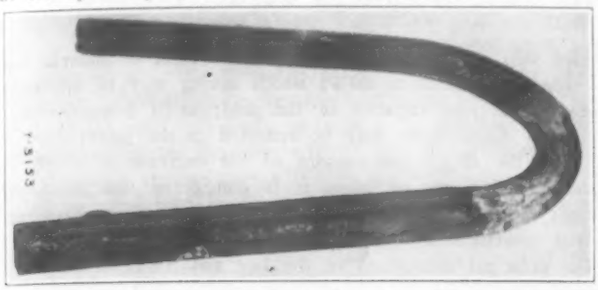


Figure 7. Photograph of a Bend Test Using Silicon Bronze Weld Metal on Steel Coupons. Specimen Was Gripped in the Middle of the Weld and the Free End Hammered. Notice the Large Amount of Bending in the Weld Metal and the Distortion That Occurred Without Failure Along the Steel Scarf. Natural Size.

rods of the same composition as the base metal with a trace of silicon added. Of course, the best conditions from a welding standpoint would be to have the base metal itself contain silicon. In that case no boiling or fuming would occur at all during the welding and sound welds could be made with the minimum of effort.

General Bronze Welding

Owing to the great extent to which brass welding rods are employed for bronze welding of steel and cast iron, the advantages accruing from the addition of silicon to the brazing rod will be even more extensively appreciated.

The tinning action of the silicon alloy is the same as that of the former welding rods except that, due to the fluxing action of the silicon, less flux will be required to cleanse

Figure 8. Photograph of Tensile Test Fracture in Silicon Bronze Weld Metal. Metal Is Sound and Very Fine Grained. Silky Shear Fracture Indicates Good Quality of Metal. 2X.

the base metal. Very few zinc fumes are given off either as the rod is melted or during the welding. This is of special value, as not only are the toxic effects of the fumes avoided but no white deposit is formed to mar the appearance of the weld. A further merit of the rod is its great resistance to overheating and remelting. Remelting the alloy several times has no effect on either the quality of the weld or the surface appearance and it is possible to reweld a small area without bringing a large area to the fusion temperature. The completed weld is free from porosity either near the base metal or in the weld metal itself and the weld metal is strong and tough as witnssed by the fracture shown in Fig. 8.

Not only are the welding properties of this rod much better, but the strength of both the weld metal and the bond between the weld metal and base metals have been materially increased. The values for these have been found to be:

Ultimate Strength of Weld Metal.....50,000-60,000 lbs. per sq. in.
Per Cent Elongation in 2 Inches of Weld Metal 12%-19%
Ultimate Strength of Bond Between Steel and Weld Metal.....40,000-44,000 lbs. per sq. in.

In this table are given the minimum and maximum values obtained from different composition alloys. The most valuable improvement has been the increase in the strength of the bond between the base and weld metals, as this is the weak point in the joint. This new range of values represents about a 10 per cent to 15 per cent increase over corresponding values for former rods. In addition the weld metal is sound and fine grained as shown by the shear type of failure when subjected to tensile test. The fracture shown in Fig. 8 was of metal having 51,000 lbs. per sq. in. strength, 18 per cent elongation in 2 inches and 42,000 lbs. per sq. in. strength of bonds to steel. Further evidence of the high strength bond and ductile weld metal is shown in Fig. 7 illustrating cold bends in the as welded condition.

Similar results in regard to general good welding quality and increased strength of bond between weld and base metals were found when the rod was used to bronze weld cast iron

Figure 9. Photomicrograph of Silicon Bronze Weld Metal Showing Its Uniformity and Freedom from Porosity.

pipes. Due to these improved values a plain vee type weld with but slight reinforcement has been found to develop consistently over 90 per cent of the average strength of cast iron pipe, an increase of about 15 per cent over the strengths obtained from former rods.

The new alloy is also especially valuable for building up wear resisting surfaces on cast iron and steel, as it is not only harder than the weld metal from other bronze used for the purpose, but is also free from porosity.

We have, therefore, a bronze welding rod available to the welding industry that has the following characteristics:

1. It is equally adaptable for steel, cast iron or brass alloys and produces sound welds in all applications.
2. It produces a weld metal that is tough, of high strength and good wear resisting properties.
3. It produces a high strength bond between the weld metal and ferrous base metal.
4. The evolution of zinc oxide fumes is practically eliminated, resulting not only in a neater appearing finished job, but in greater comfort to the operator and a more satisfactory weld.

APRIL MEETING OF THE CHICAGO SECTION ADDRESSED BY MR. A. M. CANDY

On the evening of April fifth the Chicago Section of the American Welding Society held its regular monthly meeting in the auditorium of the Engineering Building. The meeting opened with the showing of a motion picture film entitled "Asbestos, The Magic Fibre" which had been kindly supplied by The John-Manville Corporation. Following this, Mr. A. M. Candy, Arc Welding Engineer, of the Westinghouse Electric & Manufacturing Co., spoke on important applications of arc welding.

Will Build Welded Ships

Several New and Interesting Design Features Embodied in Plans of Welded Barges to Be Built in Eastern Yard

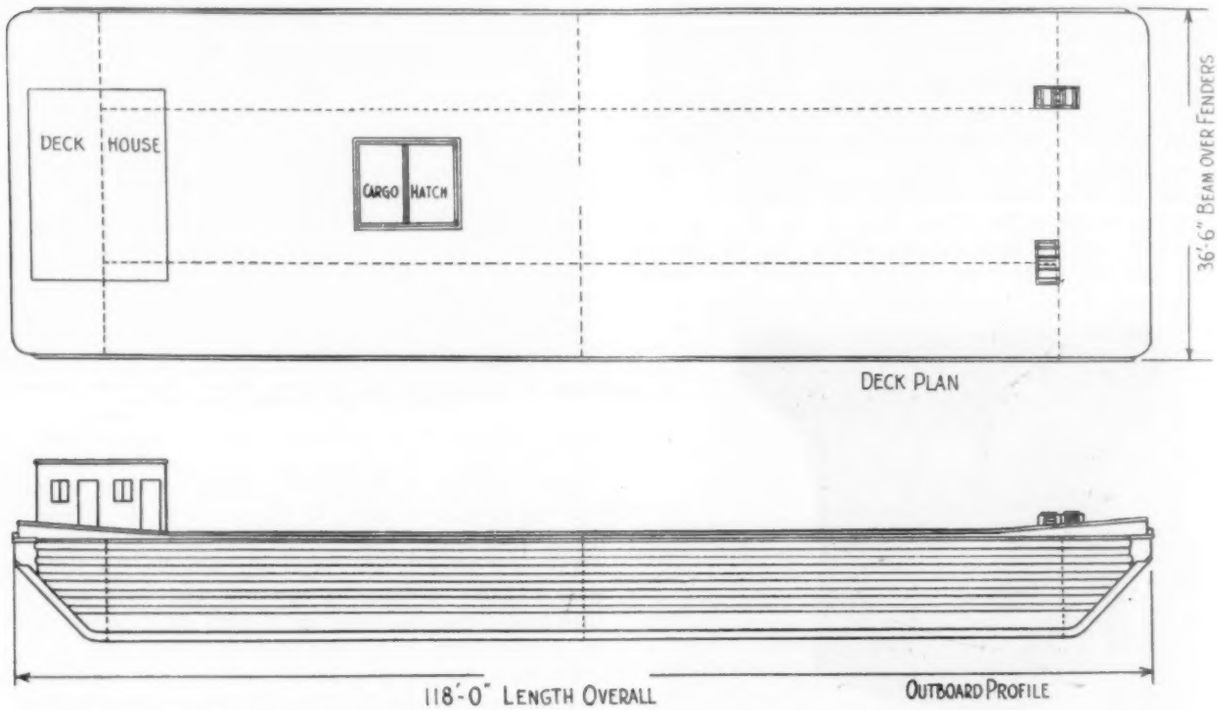
MR. L. Y. SPEAR, Vice President of the Electric Boat Company, announces that their New London Ship & Engine Works at Groton, Connecticut, is being equipped to undertake the construction of completely welded ships. Their first contract for this novel construction is for a 1,000 ton steel deck barge for Lee and Simmons, 44 Whitehall Street, New York City.

All who have been in touch with ship construction for the last ten years are familiar with the ever increasing use of electric arc welding on shipboard; but few ships have heretofore been built with the entire omission of riveted joints; nor can such a structure be built unless the design from the beginning has been thoroughly worked out and calculated with this end in view.

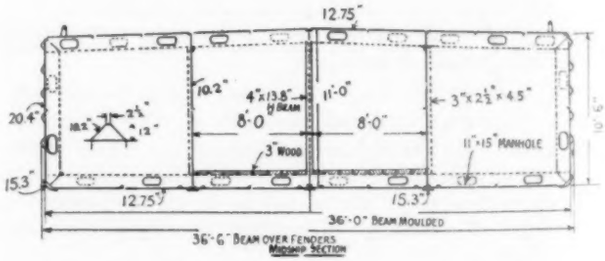
The design for the Lee and Simmons barge has been developed by Ewertz and Dalcher, Consulting Engineers, 50 Church Street, New York City, and the patented features of this construction are covered by U. S. patents taken out by Mr. Ewertz. Before the welded ship became practical, steel and iron ships have been held together by rivets. This construction requires first a detailed plan or a wooden mold showing the location of each rivet; the cutting and bending of the material to the actual curvature or size; the punching and or drilling of the holes; the bolting in place, the driving of the rivets; and in case of watertight work, the chipping and calking of the riveted seam; all of which takes time, and the employment of a half-dozen or more different trades, during the process of laying out and erecting. The punching of so many holes in straight lines through a plate or in the framing reduces the strength of the section sometimes as much as 25% or 30%. Much of this work is eliminated in the electric welded ship, and for equal strength the weight of material may be reduced as much as 20%; which saving may be applied to increased carrying capacity of the ship; or if power-driven, a saving in displacement may be reflected in the power required to drive the ship. On account of the decrease in weight of material and hours of labor, it is considered that substantial savings in cost can be made as compared with the conventional riveted construction.

The principal dimensions of the Lee and Simmons barge are as follows:

Length overall	118 feet,
Max. Beam over fenders	36 feet, 6 inches,
Depth at center	11 feet,
Deck load carrying capacity	1,000 tons,
Cargo space in hold	16,000 cubic feet,



Principal Details of New Type Welded Barge



The barge is sub-divided by two longitudinal watertight bulkheads; two transverse watertight bulkheads near the ends; and one non-watertight transverse bulkhead amidships.

On the aft end of the barge there is erected a steel house for living quarters, with space provided for a power cargo hoist, if desired.

The bottom of hold throughout cargo space is sheathed with a wooden floor, and all compartments below decks are thoroughly ventilated.

In preparing the design, the requirements for quantity production have been kept clearly in mind throughout so that a yard with a limited water front or with few launching ways may assemble large sections at any convenient spot and transport them to the launching ways for erection. All shell and deck plates of the same thickness being of identical dimensions are largely interchangeable throughout the structure. When flanged at the mill, all such parts may be delivered directly from the cars to the structure without first going through the yard fabricating shops.

It will be noted from the illustration that a 3" flange is turned on one longitudinal edge of each shell or deck plate. The longitudinal edge of the adjacent plate is butted against this flange member and welded thereto so that each longitudinal weld is reinforced by a 3" flange giving great strength to the joint. The transverse frames are made of flanged plates 12" deep and of triangular construction. The hypotenuse of the right angle being placed against the shell of the barge and intermittently welded thereto. As these flanged plates are cut to length at the mill, fabrication required at the yard is reduced to a minimum. The fenders are of special shape and construction as shown; wood-filled and welded to the outside shell plating. They form a very strong fore and aft tie, and on account of their special shape will prevent riding on adjacent barges.

All welding will be done under the most careful supervision, and by workmen who have first qualified by tests adopted by the American Welding Society. Electric welding will be used throughout from power furnished by General Electric Type WD-300 ampere welding machines. All material entering into the construction of the barge will be of a grade to meet the American Bureau of Shipping specifications.

WELDING SYMPOSIUM AT LEHIGH UNIVERSITY

Lehigh University is ideally situated on the side of a hill in Bethlehem, Pennsylvania, overlooking the Lehigh River and the giant plant of the Bethlehem Steel Corporation. This location is practically the hub of the largest cement country in the United States. It really gives the Lehigh University engineering student the opportunity of seeing the classroom theory worked out in practice almost on his own campus.

In this vicinity electric welding (arc and resistance), oxy-acetylene welding and cutting are extensively used.

The Lehigh University Welding Laboratory is equipped for thermit welding and oxy-acetylene welding. It also has General Electric, Lincoln and Westinghouse Single Operator Arc Welders, an Automatic Metallic Arc Welder, Thomson Spot Welder and Federal Butt Welder. In addition to these it has a small Box Type Electric Furnace and a High Frequency Electric Furnace.

The Welding Symposium held April 8, 1929, was an all-day session. It was opened in the Auditorium of Drown Hall by Doctor C. R. Richards, President, introducing Mr. F. L. Llewellyn, President of the American Welding Society who gave a splendid paper entitled, "Welding Operations and Their Practical Results." This was followed by general discussion by those in attendance which numbered between four and five hundred and included Faculty, graduating students, engineers, superintendents, foremen, welding operators and mechanics of plants from the surrounding country.

The afternoon session was devoted to demonstrations in Williams Hall Welding Laboratory. Automatic Welding was in charge of Mr. J. Cumberland, General Electric Company. Metallic Arc Welding in charge of Mr. D. Anderson, Lincoln Electric Company. Stellite Welding by Metallic Arc Process in charge of Mr. R. D. Thomas of R. D. Thomas and Company, for the Westinghouse Electric and Manufacturing Company. Electric Pressure Butt Welding in charge of G. A. Hughes, Federal Welding Company. Electric Spot Welding in charge of R. S. Donald, Thomson Spot Welding Company.

In the Physics Building there was Oxy-acetylene Welding, Oxygen Lance Cutting, Thermit Welding, Atomic Hydrogen Arc Welding.

In the Fritz Engineering Laboratory tests of the welded specimens were made for tension and torsion. A full size arc welded structural sample was tested in the University's 800,000 pound compression machine. An Oxygen Lance cut a hole through the center of a steel billet 6"x6"x24". It also cut steel covered with concrete.

In the Taylor Gymnasium swimming tank the Under Water Metal Cutting Corporation demonstrated cutting steel and cast iron bars under water by an electric arc oxygen lance. This was done by an expert in diver's costume. The work was in charge of Mr. F. F. Hagglund who is an Alumnus (1917) of this University.

At Left—Compression Test of Structural Weld. At Right—Two Views of Oxygen Lance Demonstration.

The evening session was held in the Auditorium of Drown Hall. Mr. Peter P. Alexander of the Eli Thompson Laboratory, East Lynn, Massachusetts, read a paper entitled "Recent Scientific Progress in Welding." In addition to this, short talks were given by the following:

Mr. A. M. Candy, General Engineer of the Westinghouse Electric and Manufacturing Company, showed the great part that welding played in our daily lives by taking a trip with an imaginary friend from the time he arose in the morning from an all-welded bed in New York City until he arrived, via a welded aeroplane, at a welded hotel in Hot Springs, Virginia. He also described with lantern slides miscellaneous structural steel operations.

Mr. D. Anderson of the Lincoln Electric Company showed slides on replacing castings with welded structural steel.

Mr. W. B. Miller, Linde Air Company, talked on structural welding by gas method.

Mr. Deppler, Thermit Metals Corporation, told of new methods and designs in Thermit Welding.

Mr. G. A. Hughes, Federal Welding Company, talked on the proper method of making butt welds.

Mr. R. S. Donald, Thomson Spot Welding Company, told of spot welding and its rapid advancement.

A Symposium of this kind requires about two months hard work in preparation and great credit should be given to Dr. C. R. Richards, President, Professor Bradley Stoughton, Dr. G. E. Doan, Metallurgy Department, Professor N. S. Hishman, Professor S. S. Seybert, Professor M. Anderson, Electrical Engineering Department, Professor R. J. Fogg, Professor R. Jensen, Civil Engineering Department, and Dr. Petersen, Physics Department, for their splendid services in this event.

The Symposium was well worth attending for it gave an opportunity to see welding against a background which was strictly scientific and unbiased.

Train the Welder

How Aircraft Welders Are Prepared for Their Work and Then Checked Systematically With Qualification Tests

By F. G. Crisp*

THE advantages of arc and gas welding in connection with the assembly of metal structures are being realized more each day. No one doubts the future will witness rapid advance in the use of welding and the field will eventually include all strength work of joining structures now done by riveting.

Welding can no longer be considered experimental in any sense of the word, having been tried in practice in every field of work to which it is suited. That phase of its development having to do with proper design of welded structures is past. Structural designers are now competent to design all welded structures properly to obtain all of the advantages of welding: saving of weight and cost and strength and tightness.

Is the future of welding assured? It has occurred to me that one phase of its development is being badly neglected, and that the results may be serious and may retard the advancement of the art of welding, if not corrected very quickly. The phase of welding to which I refer is the proper training of welders.

"A"—Test Plate—Showing Flat, Vertical and Overhead Test Welds Before Cutting Out Specimens.

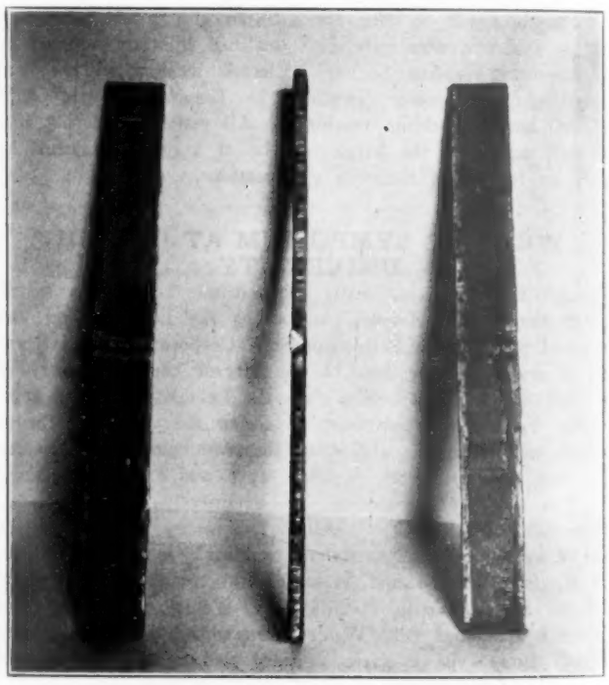
Are we not taking for granted that the man who is doing the welding is getting the results we desire? The tendency in the last three or four years of letting up on this training and accepting at face value any one who says he is a welder certainly indicates this.

The proper design of a welded structure presents no difficulties. The average structural designer with fair practical experience can become a satisfactory designer of completely welded structures in a reasonable time. Strength calculations are not difficult to make. In such calculations, however, we must assume the ultimate strength of the weld metal and calculate our stresses in a similar manner to other design. Are we sure of our assumed strength of weld metal? We are not, unless we are sure of our welders.

The Navy has probably been interested in the possibilities of welding very much longer than others in this country, particularly since strength welding was introduced. The earliest experiments were concluded in our Navy Yards, and details of welding developed and perfected many years ago. There has always been considerable hesitancy, however, to weld either the minor or major strength members of our large warships. The Limitation of Armaments Conference, however, limited the size of naval vessels and, therefore, made the saving of weight of the greatest importance. The use of welding provides the easiest way of saving weight and hence welding in naval construction has been given a great impetus. So far as the Navy is concerned, the welding of structural strength members of vessels is off to an excellent start, and it is reasonable to assume that it will supplant riveting more and more, until we have an all-welded ship. Whether or not that goal is reached, depends, in my opinion, largely on the man making the welds. If he is well trained and capable, it is not believed that there is any question of the result.

Persons who have studied results of welding believe that welders should be trained even more carefully than other skilled artisans; that a complete apprenticeship of four years should be required to qualify a man for important strength work, and even then he should not be permitted to perform such work unless he passes frequent strength tests satisfactorily and can otherwise prove that his work is good.

There is now established at the Norfolk Yard an apprentice course for welders. Not only are the usual apprenticeship subjects taught, but effort is made to teach all welders the fundamentals of electricity, particularly as they apply to welding and welding apparatus. The idea is that such training will better develop the young man and make him more able to perform his work correctly. The necessity for this is shown by the lack of such knowledge on the part of the older welders. No effort is made to develop these welders rapidly and they are allowed to gradually perfect themselves in the art, having been taught the fundamentals. It is true that some boys or young men can become excellent welders in a relatively short while, and pass the required tests. The majority do not, however. What is considered as equally important is that results be consistent, whether or not above the average required, so that the day to day output that cannot be tested may be depended on. Eventually such train-



"B"—Specimens Cut From Test Plate.

Commander (C. C.) U. S. Navy, Norfolk Navy Yard.

ing produces welders who are expert, not only from the point of view of strength, but speed. At the present time the four years period is considered the proper length of time for such training.

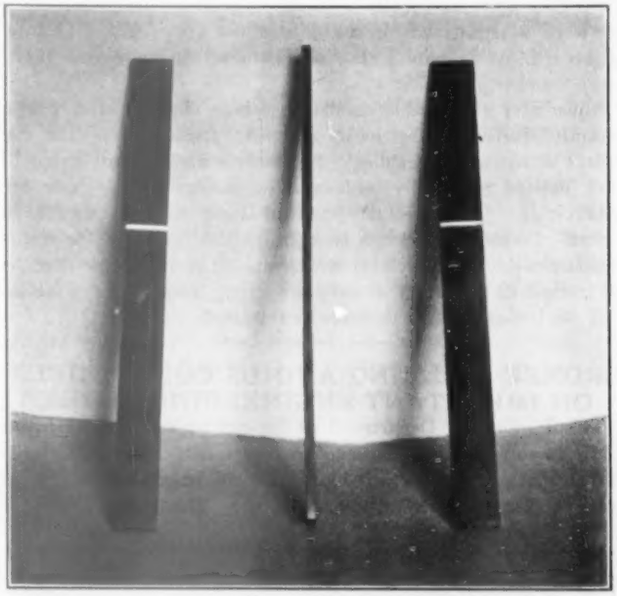
In addition to the training given apprentices, all welders of the Yard are required to pass welding tests semi-annually. These tests consist of welding together test strips; the welding to be done in each of three positions: horizontal flat, vertical and overhead. The apprentices are required to take these tests also; they are, however, not required to pass the tests until their training is considered adequate. The results of these tests are extremely interesting and are tabulated below:

RESULTS FROM SEMI-ANNUAL TESTS—WELDERS—NORFOLK NAVY YARD.

Check No.	Over-head.	Verti-cal.	Flat.	Aver-age.
No. 4	25,558	35,751	49,937	37,082
No. 6	57,500	50,255	61,922	56,559
No. 7	43,333	52,375	55,585	50,431
No. 9	63,669	56,036	60,731	60,145
No. 10	38,904	53,844	45,180	46,009
No. 11	58,346	59,310	60,551	59,402
No. 12	44,978	41,733	63,307	50,006
No. 17	59,671	38,912	57,448	52,010
No. 20	47,549	58,177	62,075	55,933
No. 21	30,090	40,429	41,733	37,417
No. 25	49,633	51,071	47,086	49,263
No. 26	52,857	50,507	55,746	53,036
No. 27	58,968	55,416	58,864	57,749
No. 29	62,366	48,000	62,270	57,545
No. 30	49,702	55,029	57,175	53,968
No. 31	53,435	48,424	58,319	53,392
No. 34	57,291	52,835	51,479	53,868
No. 35	42,837	35,875	53,780	44,164
No. 36	47,230	54,509	58,698	53,479
No. 43	50,595	39,319	46,545	45,486
No. 44	51,129	56,000	57,079	54,736
No. 46	53,091,	56,857	55,355	55,101
No. 52	56,224	55,944	56,452	56,206
No. 53	43,043	52,721	59,809	51,857
No. 54	53,651	48,153	61,277	54,360
No. 66	51,503	57,971	55,295	54,923
No. 69	50,365	43,348	63,820	52,511
No. 71	50,024	43,760	46,403	46,729
No. 72	49,428	51,696	60,895	54,006
No. 73	58,256	51,117	50,043	53,138
No. 74	38,961	38,791	63,177	46,976
No. 75	37,122	40,151	40,938	39,403
No. 76	44,312	45,555	63,141	51,002
No. 77	51,162	49,110	60,733	53,668
No. 80	56,394	41,832	59,103	52,443
No. 85	64,367	47,708	63,325	58,466
No. 66	54,046	53,220	57,336	51,867
No. 83	51,841	44,378	58,205	51,474
No. 84	43,114	49,175	44,412	45,567
No. 91	54,782	52,021	51,576	52,793
No. 92	40,669	42,345	57,529	47,014
No. 94	52,753	60,630	49,531	54,304
Average	50,017	49,066	55,806	51,630

Each welder is assigned a number and all test specimens prior to sending to the laboratory for test are marked with this number. When the tests are made the welder's name is, therefore, not known. The photographs show the test speciments as made, after marking for test and after test. Two plates are joined together by welding from three positions—flat, vertical and overhead. Specimens for tests are cut so that the two halves of each specimen are joined by welding performed from one of the positions. Specimens are machined flush and to dimensions as shown in Photograph "C" and are broken in tension in a standard testing machine. The ultimate strengths per sq. in. for the various types of welds are determined from the areas of the sections. Welders are assigned to important strength weldings only when they can obtain an average of 52,000 sq. in. for the three welds with a minimum for any one position of 45,000 sq. in.

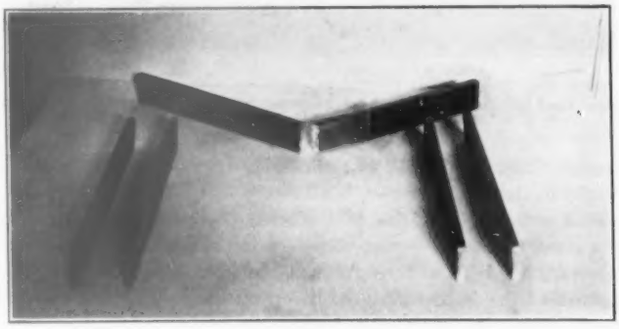
Good welders properly trained will produce good results consistently equal or better than the average required. On the other hand many men welding every day for many years will never be good welders. These men have no natural talent and the chances are all against them having had proper training in the fundamentals. Nineteen out of forty-two in the above list did not pass the required test. Of these, four are apprentices in their first year. It is usual, however, to find about 30 per cent of the accepted welders unable to pass a satisfactory strength test. A further analysis of these will show that the



"C"—Specimens Machined For Strength Test.

big majority have not been trained. The trained welder passes the tests without difficulty. Some apprentices will produce excellent results within a short time. The average do not and are not consistent.

It is worth noting that the variations in the ultimate strengths are wide, indicating that all welders are not good, that welds are not made in the same manner by different men, although made under identical conditions. It is the intent at the Norfolk Yard to develop the proper technique in every apprentice welder;



"D"—Specimens After Tests.

to do this while he is young and easily taught and to endeavor to standardize the methods of welding so that the work of different welders will develop approximately the same strength and, what is considered the most important, to obtain consistent results from the same welder.

If test of a welded ship structure were practicable, we would not have to depend so much on the welder. If test of a weld to the extent that a rivet is tested were practicable, we could

develop welding along those lines. There is no practicable test except appearance of the weld and faith in the welder to produce welds of the designed strength. Therefore, why take unnecessary chances on the welder with the possibility of disastrous results to the art of welding.

There is a tendency to look upon the art of welding as a skilled occupation on the part of a welder instead of a skilled mechanical trade. When so considered, an apprentice course is not required and a welder is accepted for employment after one or two years of so-called practical training. Such training may or may not be on welding similar to that required in strength work and probably is not. The average welder today, who is not trained in a shipyard or other plant having a well-developed apprentice system, usually gets his experience on miscellaneous work of a nature where strength is not considered. This fact is proved by examining the applications for employment of a large number of welders.

Some very remarkable results have been obtained with welding recently, justifying the most optimistic predictions of the most ardent advocates of welding. In shipbuilding, weight saving has been desired principally, although the savings in cost have been appreciable. There is no practical limit to the amount and extent of similar work to be done in the future. The cost of training welders properly is not great. It is important that they be trained to perform the work properly. The future of welding will be jeopardized if they are not trained.

BRONZE WELDING AVOIDS COSTLY DELAY ON IMPORTANT ENGINEERING PROJECT

The Engineering Department of the city of Waterbury, Connecticut, is constructing a secondary or auxiliary pipe line, known as the Steele Brook Project, to convey Waterbury's water supply from its huge Morris Reservoir, which is fed by the newly constructed Shepaug Tunnel, an engineering feat well known in Water Works circles.

Fig. I.
View Looking Down the Tunnel Showing Mixing Platform of "Concrete Gun" and Cover Arm of Inlet Door (marked X).

This secondary pipe line is conducted from Morris, Connecticut, to a point about three miles above Watertown where it was found necessary to drive a bore through the hills for about 1½ miles because of the impossibility of diverting the line by a circuituous route, around the intervening high ground.

The tunnel is about 8 feet in diameter and is being finished with a facing of concrete, which reduces the bore to 6 feet 6 inches. The concrete facing is laid by a concrete placer which is locally known as a "concrete gun," and has a working capacity of 80 cubic yards per eight hour shift. The entire apparatus is about 280 feet long, consisting of a mixer, platform and feeder pipe.

While in operation, a break occurred near the knuckle joint in the arm holding the inlet door where the concrete is served from the mixer to the revolving worm, which in turn feeds the concrete to the blower pipe.

The inlet door is serviced by a compressed air plunger which operates automatically under a ninety-pound working pressure, to shut off the flow of concrete to guard against overloading.

The gang of thirty-two men working on the job were faced with a lay off until a new door arm could be procured and repairs effected. The engineer in charge figured that it would require about five days to procure the new part from New Jersey and reassemble it in the machine. This would have entailed a loss of nearly $800.00 to the working gang, because of time lost until the machine was operating again, to say nothing of the delay in making progress on the construction work.

The details of the problem were submitted to Mr. Charles Gallo of the J. L. White Welding Co., Inc., Waterbury, Connecticut, who transported welding equipment to the scene in the tunnel and repaired the broken arm by oxy-acetylene welding, with Tobin Bronze Welding Rods.

The break occurred at 2 P.M. and repairs were so quickly affected that the machine was ready to operate on the same day at 8 P.M.

Fig. II.
Close-up View of Inlet Door with Welding Portion of Arm Outlined in White.

Because of the comparatively low heat required for bronze welding, repairs were made with the broken parts in place, no dismantling being necessary. If cast iron welding rods had been used in this instance, dismantling of parts would have been necessary in order to avoid danger of warping through expansion and contraction because of the high heat required for the fusion welding of cast iron.

The advantage of quick transportation of oxy-acetylene welding equipment to even the most inaccessible places are clearly demonstrated on this job, which was welded underground about 1¼ miles from the opening of the tunnel mouth.

Another factor which governed the selection of bronze for the welding medium was the strength of the bond made with this special welding material. It is generally from two to three times the strength of cast iron and is particularly well adapted to the stress and strain of shock, which must be sustained by this particular moving machine part.

Actual welding preparation required about one-half an hour of time. Twenty-four cubic feet of acetylene and twenty-four cubic feet of oxygen were used, together with approximately one pound of ¼-inch Tobin Bronze welding rod.

The machine has now been operating continuously for two months with no sign of impending breakage.

This job is a fitting illustration of the service which is being rendered industry through the use of bronze welding. It is equally serviceable for repairs made to either cast iron or steel. Welds can be made by merely bringing the cleaned welding areas to a bright red heat and melting on the bronze. This process effects a substantial saving over other welding methods which consume more gas and require considerably more time and labor because of the pre-heating generally required by the slower processes of fusion welding.

Welded "Battleship Deck" Floors

Plan for an All-Welded Steel Floor Which Meets All Requirements of the Builder Plus Several Marked Advantages

By L. H. Miller*

(Mr. Miller has just started investigation of a new type of floor construction which is known as the "battleship deck" floor. This is a steel plate floor, which it is estimated, will give greater strength and stability to buildings, reduce the loads on the columns and therefore be especially valuable in skyscraper construction. Mr. Miller has given the following outline of this floor system.)

THE only reason for constructing a building is to provide a floor which can be protected from the weather by walls, windows and roof covering. The only reason for wanting a floor is to provide supports for a live load.

When the skyscraper came into existence it provided multiple tiers of floors, one above the other supported on a steel skeleton frame consisting of steel columns, girders and beams. At that time the steel industry furnished only the skeleton frame which provided supports for the numerous floor panels. The industry stopped at this point and permitted the general contractor, the architect and the engineer to devise some means of filling in the floor panels which were originally made of brick arches, later of flat tile arches, and still later of other types of material such as wood, packed floors, reinforced concrete and Gypsum.

At the inception of the multiple story tier building, the art of welding was unknown as it now exists, but the progress which has been made in this field has made possible the development of a type of steel floor which should meet every requirement that a floor construction is called upon to perform.

There is probably no part of a building structure which, under present conditions, has been more unsatisfactorily developed than the floor panel construction, and yet it is the one reason for having a building. Present methods of construction involve the use of material, in the floor panels, which constitute a dead load that is generally considerably more in weight than the live load which is to be supported. This excessive dead weight of the floor panels must be carried into the skeleton frame, girders and columns, and ultimately to the foundations. It is evident that one of the conditions which limits the heights of multiple story buildings will therefore be the capacity of the foundations to carry the dead load of the structure, which is greater than the calculated live loads. A reference to the column schedule of a multiple story building will reveal that the column stresses for dead loads are often approximately two-thirds of the total stress, the other third being live load.

By the use of steel plates and ordinary structural steel beams, it is proposed to develop a welded steel floor which will be better than any floor that has been used before, and will stand every service that it may be subjected to. It will be a floor in which it is possible to determine in advance, the stresses in all parts, and a floor that will recover instantly a full hundred per cent of its deflection, due to live load when that load is removed. The one objection to such a floor system is that it has not been used before.

Live Load Capacity of Building Increased

It is proposed to have 3 in., 4 in., 5 in. or other rolled I beams of whatever depth is found necessary, spaced 24 inches apart and spanning from girder to girder of the structural steel frame. Along the tops of these beams will be laid continuous steel plates $\frac{3}{8}$ in. or $\frac{1}{4}$ in. in thickness, and wide enough to leave a space between their edges approximately $\frac{1}{4}$ in. wide. The edges of the plates will be immediately over the center line of the webs of the small beams, and an automatic welding machine then works along this joint between the plates and welds the edges together, and at the same time welds them to the top flange of the beam immediately over the web. The result is a built up T section with the plate acting as the upper flange and the beam acting as the vertical part of the T. The neutral axis of the combined T section will be close to the top flange of the beam, and when the lower flange of the beam is stressed 18,000 lbs. per square inch, the plates and the top flange will have a stress of only 3000 lbs. to 4000 lbs. per square inch.

By using a 3 in.-5-7/10 lb. I beam, and a $\frac{3}{16}$ in. plate, such a floor construction will carry a total load of 190 lbs. per square foot on a 10 foot span with a deflection of .07 in. The same floor will carry a total load of 85 lbs. per square foot on a 15 in. span with a deflection of .157 in. The weight of the steel work including beam and plates for this floor, will be 10½ lbs. per square foot.

By using a 5 inch 10 lb. I beam spaced 2 ft. centers, and a ¼ in. plate, the combination will sustain a total load of 240 lbs. per square foot on a 15 ft. span with .098 in. deflection, and on a 20 ft. span will support a total load of 135 lbs. per square foot with .174 in. deflection. The weight of the steel work in this floor will be 15-2/10 lbs. per foot.

It is, of course, assumed that this combination construction will be made continuous over the tops of the supporting girders, or by framing them into the girders flush on the top and have the floor plates continuous. The loads above given are based on fixed end supports, and the deflections are determined by the same basis.

The next question which arises is what will be the strength and deflection of the plates between the supporting I beams to which they are welded, which are 24 in. apart. A ¼ in. plate will carry a uniformly distributed load of 562 lbs. per square foot, and have a deflection of .115 in. between the small beams. This plate will carry a load concentrated between the small beams of 750 lbs. per linear foot, and have a deflection of .057 in. Under the same conditions the $\frac{3}{16}$ in. plate will carry a uniform load of 316 lbs. per square foot, or a concentrated center load of 422 lbs. per linear foot. These loads are, of course, far in excess of what the T section will develop, and indicates that the floor construction is amply safe in both directions.

The cost of welding the bead between the edges of the plate and to the top of the beams has been estimated by different contractors, and one of them has stated that with automatic machinery it should be possible to deposit the bead weld for less than 2c per linear foot. Another contractor has stated that he is ready to enter a contract for this welding at between 3c and 4c per square foot of floor. Inasmuch as the welding will be done along a line, but a short distance from the neutral axis, the difficulty of the floor curling up due to shrinkage will be practically negligible.

Continuous Floor Structure Reinforces Building

With this type of floor construction there is generated a solid steel deck which will act as a girder to prevent any torsional distortion of the building when subjected to wind or earthquake action. It will enable the engineer to select that part of his structure which is to carry the wind stresses to the foundations, and be assured that the deck flooring will deliver the stresses to the most rigid part of the vertical frame. The floor construction can be carried out into the walls to provide spandrel construction to support the outside walls. It will, of course, be necessary to fireproof such a floor when the combustible contents of the structure will generate a heat that will produce a temperature in the steel in excess of 1000 deg. F. This fire protection can be taken care of either by cast blocks of fireproofing inserted on the lower flange of the small beams, or by metal lath and plaster ceiling. Either type of construction will provide openings for conduits which can

be carried along the main girders and transversely under the steel plates between the small beams. On the other hand if it is found advisable to do so, it will be possible to have a light fireproofing applied to the top of the steel plates and incorporating the various conduits which lie on top of the plates.

At the present time the specifications that are written to regulate the testing of floor construction, contemplate a fire on the upper surface. It has, however, been assumed that the filling which is put on top of the ordinary floor panels to cover conduits, acts as a fireproofing for the top flange of beams and girders. On the other hand, if our grate bars and furnace construction is a precedent, it should be possible to have a very considerable fire on the top of the steel plates without the temperature becoming dangerous. This is due to the fact that all heat generated from combustion will rise, and all air necessary to feed combustion must come from near the floor.

It will be possible to provide any form of treatment to the top surface of these plates, either mastic finish, linoleum, cork tile or other forms of coverings. The Armstrong Cork Company have stated that they recently took a contract for furnishing approximately 40,000 square feet of cork tile floor for the Cleveland Terminal Tower Building at a price of 42c per square foot. This cork tile is 3, 4, 6 or 12 in. square, and can be cemented to the top of the steel plates, providing any required Mosaic pattern, and giving a floor that will eliminate the necessity of rugs, except as ornaments.

Welded Steel Floor Costs Less

The total cost of a floor constructed of 3 in. I beams, $\frac{3}{16}$ in. plates, covered on the top with cork tile and fireproofed on the under side with metal lath and plaster, will be in the neighborhood of $1.00 per square foot. It should be remembered in this connection, however, that the cork tile flooring eliminates the necessity of any other floor coverings, which is always a part of a tenant's expense when using an ordinary concrete floor. The cost of a good quality Shenille carpet is from $1.25 to $1.50 per square foot, and the above referred floor system will cost complete less than the carpet, and eliminates its necessity.

It has already been stated that the objection to this floor is that there is no precedent for it, but this is not exactly true since the decks of battleships and the charging floors of our open hearth furnaces are all made with $\frac{3}{16}$ in. to $\frac{1}{4}$ in. plates, and are subjected to the most severe service that any floor can receive.

For bridge floor construction a combination of steel beams with checker plates could be assembled that would very materially reduce the dead load of the structure and provide a lateral rigidity more satisfactory than any lateral floor diagonal now used. It will be found that checker plate floors are used at the present time to take care of the wear on wood floor bridges, and the question of their being slippery has never been raised. In fact checker plate floors are used constantly for stair treads and landings.

This type of floor construction will weigh 20 lbs. to 60 lbs. less than any of the existing types now in use, and in connection with a proposed 75 story building with floor panels 21½x22½ the saving in dead load on the foundations for each column will be nearly 2,000,000 pounds.

NEW CHICAGO OFFICE FOR UNITS OF UNION CARBIDE AND CARBON CORPORATION

On May 1st, the Chicago district and Central Division Offices of various units of the Union Carbide and Carbon Corporation moved to the new forty-story Carbide and Carbon Building, at Michigan Avenue and South Water Street, Chicago.

Units of the Union Carbide and Carbon Corporation which will make this new building their Chicago home are: The Linde Air Products Company, The Prest-O-Lite Company, Inc.; Oxweld Acetylene Company, Oxweld Railroad Service Company, Union Carbide Sales Company, Carbide and Carbon Chemicals Corporation, National Carbon Company, Inc., Haynes Stellite Company, J. B. Bolt Company and Acheson Graphite Company. These various subsidiaries of the Corporation manufacture oxygen, acetylene, acetylene generators, cutting and welding equipment, carbon products, batteries, flashlights, chemicals, cutting tools, and a number of other products.

The building itself is an architectural masterpiece rising over five hundred feet into the air. The effect of great height inherent in its forty stories is accentuated by the absence of all horizontal cornices and projections. Sheer vertical lines are everywhere emphasized. The tower, beginning at the twenty-third continues to the fortieth story and is here surmounted by a fifty-foot campanile which forms the building's shining apex.

It is the first great structure in Chicago to embody a free use of color in its exterior design. The sides are tiled in varying shades of green and terra cotta, relieved by a plentiful use of gold terra cotta on the top of the tower, on the campanile, and above the lower stories where polished black granite forms the building base. At night the gold decorated tower is floodlighted with a battery of powerful searchlights.

The general decorative treatment, so admirably executed, was developed from basic plans originated by Mr. J. R. Marsh, of the Carbide and Carbon Realty Corporation.

Handsome bronze doors grace the main entrance on Michigan Avenue. The lobby is two full stories in height, providing an interior of unusual beauty. The wall base is of black and gold marble, with wainscoting of Notre Dame inlaid with bronze. The ceiling is of ornamental plaster finished in various attractive colors. Bronze is featured in the metal trim on the mezzanine floor of the lobby and on the elevator landing and main stairs.

The elevator system combines many features which are worthy of note, such as automatic stop, push-button control, automatic leveling at all floor landings and automatic spacing of all cars in the shaft. This is the first time this complete system has been installed in Chicago.

Offices are fitted with sound-proof ceilings, and the lighting fixtures are of no-glare construction. One of the distinct innovations in the office treatment, is the Gerdes System of artificial ventilation which assures a constant distribution of fresh air at all times.

On the thirty-fourth floor are found the executive office suites of the Union Carbide and Carbon Corporation. They are finished in Early English and Early American style. Decorations and furniture are in perfect keeping.

For the convenience of visitors the corporation maintains a showroom at the street level, with entrance from South Water Street, connecting with the Michigan Avenue entrance by an inner corridor. In this showroom, one may view many products of the various companies. An attendant will be available at all times to explain these products and their yarious uses.

Precedents in skyscraper office building construction have been set by two innovations which are exciting much favorable comment.

Accommodations have been provided for tenants' automobiles. The first basement is largely a garage, and entrance may be gained from the lower level of Michigan Avenue by way of Garland Court. This parking space and its easy mode of approach eliminates the necessity of tenants parking their cars at an inconvenient distance from their place of business.

Oxwelded piping has been used for a major part of the building's arteries. From boiler room to tower the steam lines, 2½ in. or more in diameter, have been oxwelded throughout. An 8-in. and a 10-in. steam line rises from the boiler room, two floors below the street, through a pipe shaft. The 10-in. riser supplies all the floors below the twenty-third by down-feed risers from a loop on this floor. The 8-in. riser ascends to the tower, with branches at each floor level. At the completion of the job a test for leaks showed the welded construction 100 per cent perfect. Fire lines, automatic sprinkler mains and brass hot-water mains are likewise of oxwelded construction.

Prominent architects and building engineers have pronounced the building the last word in architectural beauty and the ultimate in business tenant accommodation.

Sterilizing the Price Germ

The Tank Business Has Suffered from Efforts to Do Business on a Price Basis—The Remedy Is to Sell Quality

By J. D. Tierney*

I IMAGINE an existing city of considerable size located on the banks of a stream that is polluted at its source. The inhabitants of the city draw their water supply from this stream. The natural result is that the people of the city are repeatedly striken with maladies like typhoid and kindred disorders.

The continually existing unhealthy conditions, in due time, educates the people of the community to maintain many physicians. Specialists are attracted to the city because it offers them excellent opportunities to use their skill in saving lives. Physicians and specialists are successful in combating some of the ravages of the disease germs, but despite their unceasing efforts, many valuable lives are lost.

As the epidemic of disease continues to grow and thrive, at the cost of lives and great financial loss to the city, the inhabitants, continually under the fear which disease can instill in the minds of the people, scour the world for more medical skill, in hopes that other talented specialists can find the right remedy to overcome the plight of the community.

"But," you might exclaim, hearing of such conditions, "why do not these suffering people go to the source of the stream and take away the pollution element?"

That, of course,, would be the right thing to do.

The reason why the source of the stream is not sterilized, is because most people tamper with *effects* and let *causes* remain undisturbed. Being sick, they take medicines or have surgical operations performed, very seldom inquiring as to what *makes* them sick and *makes* medicines and surgical operations apparently necessary. *Symptoms* are given attention while the *cause* of the symptoms is neglected.

The Germ at the Source of the Tank Business

In conducting a profitable tank fabrication business, the type of healthy business which will profit the tank buyer as well as the tank maker and seller, it is well to stop and consider the tank business stream.

The origin of the tank came at a time when *materials* and *fabrication* of materials, could be used together, to offer a thing of utility for the use of mankind. This thing, this new commodity, was called a tank.

Men with capital saw the possibilities of its necessity to the everyday needs of mankind. They purchased the rights to develop and perfect it, turn it out in quantities, advertise it and sell it. They made tanks from the very best of materials and with painstaking workmaship they turned the materials into a high quality product, for which they received a good price and a good profit. They made money.

The buyers of the tank products received a value consistent with the price they had to pay, because the sellers, even in those early days knew that a remarkably good value was the very best form of advertising and their slogan,—"it isn't so much, how much you pay, as it is what you get, for what you pay," guaranteed the buyer of their product, that he would receive full value for his initial expenditure.

Other men with capital saw the tank business of the originators grow. They realized and could vision the future success of this type of business. They devised similar manufacturing facilities and produced similar tank products. Competition was born.

Under the spur of competition all the tank makers endeavored to keep perfection in their tank products and at the same time lower their cost of manufacture. Competition became keener and the keener it became, the harder the makers worked and tried to lower costs and selling prices. Perfection in product must be sacrificed if the price issue was to continue under the competitive practices.

Then began the cutting of qualities in materials and workmanship.

How the "Dead Level" Arrived

One tank maker followed the procedure of the other and with lowered selling price as the only incentive and inducement for the buyer, tank products became more and more alike, so that the tank product of one maker was about as good as that of another maker, and the only difference that potential buyers, unguided and unaided by salesmanship could see in the tank products, was that of price.

In time the whole tank industry reached a dead level. It was stabilized. Like water in a dead pond, it was in a state of equilibrium. Motion in it, if any, was circular, usually around the one subject of price and the men in the industry, figuratively speaking, were running around in circles, vainly seeking an outlet.

The serious trouble with a dead level in those days, is even more serious today—it is so very deadly—and so very level.

The tank business stream today is polluted with the germ of "price." The slogan seems to be,—"lower anything, anyway it is possible, sacrifice quality in materials and workmanship, as long as we can get down, down, down to that thing called price."

Does the Buyer Really Profit?

Where does the tank buyer fit in this game of competitive cost-cutting procedure? . . . Is the buyer getting the best value it is possible to purchase? . . . If the material value is reduced and the workmanship values are those of hurried up production type, is the small initial cost saved by the buyer of these inferior qualities, worth the difference he might initially pay for the best he could get in materials and workmanship?

The answer to these questions, is decidedly and definitely,—"NO."

The tank buyer's buying, like the community in this story, is bound to suffer losses as long as he draws on the price polluted stream for his requirements.

As long as you will allow a tank buyer to see and tamper with *effects*, he will allow *causes* to remain undisturbed.

It is not entirely his fault because tank makers in the tank industry, under the spur of competition have educated him to believe that a tank is a tank, without any differentiation in qualities or values. His education entirely governs his buying and he believes he is right in buying on the one issue of price, because most tank makers are selling on the one issue of price. The product of one maker will look the same to him, as that of another maker, until he receives the knowledge, which makes him compare quality and value, versus low initial price only.

Buyers Really Want Quality

Strange as it may seem, with all this custom and condition a set thing in the tank industry, the fact still remains, that the great majority of tank buyers consider it a duty to their companies and themselves in their entrusted capacity as buyers, to purchase the most value they can receive for the lowest figure consistent with such high quality values.

Therefore, it is not necessary to manufacture and sell tanks on the one subject of initial low price which can only be attained by furnishing inferior qualities of materials and workmanship.

Let us cite one of many specific cases where a sales representative of a job welding shop called on one potential tank buyer for over two years, endeavoring to sell the buyer commercial steel tanks.

*Storts Welding Company, Meriden, Conn.

The buyer repeatedly told the salesman how his company had purchased from the same tank source of supply for more than 30 years and how his company's metallurgist advised the Purchasing Department that the tank products received from their source of supply were as good as the average products of other tank makers, if anything, just a little better than the average.

This selling resistance offered a strong barrier to overcome.

Finally the barrier was broken down when the salesman returned to the buyer with Armco Ingot Iron Plate as the base material, instead of commercial steel.

The buyer said he would refer the matter of value to their metallurgist. The metallurgist returned his decision after specimens had been worked in the company's metallurgical laboratories.

They Come Back for More

This one incident took place in October, 1927, and for the balance of that year our company received two thousand dollars business from the concern. For the year 1928 we were entrusted with producing more than ten thousand dollars worth of tank business for this same concern. In this year of 1929 their orders continue to come to us. They are one of hundreds of concerns, tank buyers, who want the most value at a figure consistent with high quality values.

Tank buyers, who are taught to know about the pollution at the source of the tank business stream, will appreciate any facts that will enable them to buy a better value, in their tank purchases. Thus, the schooled tank buyer and quality tank manufacturer, together, can sterilize the germ that pollutes the tank business stream.

THIRD ANNUAL WELDING CONFERENCE AT NORTH TEXAS AGRICULTURAL COLLEGE

A growing movement is the study of and training for welding and it seems to be a permanent one, as shown by the annual meetings held by several engineering colleges.

The North Texas Agricultural College at Arlington, Texas, is the fourth or fifth college to hold a practical and engineering conference to study the problems of welding in its region. On February 19th and 20th, its third annual welding conference was held.

Excellent papers were read by men close to the various welding applications and these were followed by thorough discussions. The variety of interest may be judged from the following partial list of papers and authors:

"General Problems of Pipe Line Welding," by Mr. R. W. Howe, President Atlantic Pipe Line Company, Dallas, Texas.

"The Manufacture and Use of Welding Equipment," by Mr. A. J. Faucek, President Modern Engineering Company, St. Louis, Mo.

"General Aspects of the Oxy-Acetylene Process," by Mr. T. W. Greene, Consulting Engineer, Linde Air Products Company, New York, N. Y.

"Manufacture and Uses of Bronze Filler Rod," by Mr. C. L. Mosley, Branch Manager, Chase Brass & Copper Company, Dallas, Texas.

During the conference it was decided that there should be a welding association, so an organization committee nominated officers and committees on constitution and by-laws, membership, etc., which were unanimously approved at the lunch time session on February 20th. It was the intent that this association become a Southwestern regional division of the American Welding Society if the National Society would accept such a branch. The regional division was planned to include a local branch at Arlington, which is midway between Dallas and Fort Worth, another at Houston and a third at Tulsa.

As welding is a very important method of construction to the oil industry, the public utilities, the railroads, the tank makers, the sulphur companies and many others in that district, it is almost certain that strong local branches will be built up and that a regional division will be justified.

The N. T. A. C. authorities expressed a keen desire to continue its annual conferences using such times as the annual meeting of the new association and looking to this association to present the public and to suggest speakers, etc. Dean Davis and Dean Dickie head up the college work, which has been carried on by Professor Rigney, Mr. Burdett and Mr. Stone.—*From International Acetylene Association Form in Acetylene Journal.*

THE WELDING ENGINEER TAKES ITS OWN MEDICINE

Members of the home office force of *The Welding Engineer* were treated to a close up demonstration of the usefulness of the oxy-acetylene cutting and welding torch when some repairs to piping in the Transportation Building, 608 South Dearborn street, were recently made. An eight-inch steel pipe extending from the basement twenty-two stories to the roof began to leak badly at joints which had been assembled by means of ordinary couplings when the building was constructed. In

Pipe Welded in Welding Engineer Office.

order to replace the defective portions of the piping in the best possible manner and at the least expense the superintendent of the building had a contractor cut out three eleven-foot lengths of the old pipe with oxy-acetylene torch and weld in three new lengths to replace them. It was easily estimated that the cost of making the repair in this manner was very much lower than it would have been to replace the defective joints in any other way and the repair is considered much more permanent. One of the joints was located in a section of the circulation department of *The Welding Engineer* shown in the accompanying photograph. It was an unusually difficult job for the welder because the old pipe was covered with several coats of paint and was badly corroded on the inside, but even with these disadvantages the job was executed to the entire satisfaction of the management of the building.

C. G. M. A. SUMMER MEETING

The date of the summer meeting of the Compressed Gas Manufacturers has been arranged. The meeting will be held June 6th, 7th, and 8th at the Seaview Gulf Club, Absecon, N. J. This is the third consecutive season that C. G. M. A. has held its summer meeting at this club. The previous meetings have been so satisfactory that the members are practically unanimous in their approval of the plans to hold this year's meeting in the same place. The summer meeting combines a regular session of the executive board with a general association meeting. It gives an opportunity for the members to attend the board meeting and take part in their affairs. The location is a favorite recreation spot and at these summer meetings the members enjoy an opportunity to combine business with pleasure for a few days. Reservations and inquiries concerning the meeting should be addressed to Mr. F. R. Fetherston Secy. of the Compressed Gas Manufacturers Assn., 120 W. 42nd St., New York City.

Arc Welding Cast Iron

Shrinkage Strains in Castings Are Reduced by Confining the Welding Heat to the Smallest Possible Area in the Vicinity of the Crack

By F. C. Owen*

ARC welding is the process of utilizing the intense heat generated in the electric arc to melt and unite ferrous metals and alloys. The electric arc creates the highest temperature known to science and after years of experimental research it was determined that when metals are united by the electric arc process, that the strength of the weld is approximately the same as in the original metal.

Enormous strides have been made in the development of electric arc welding machines in the past few years, and especial impetus was given the process during the World War, when it was found necessary to quickly repair the damage done to the German vessels by their crew when they were abandoned at American ports.

The first to attain success in the utilization of the heat of the electric arc for the purpose of making a weld was a Russian engineer named Benardos, who used a carbon pencil to form the positive electrode, forming an arc with the object to be welded as the negative electrode of the circuit. Recognizing the disadvantages of the original Bernardos system, another Russian engineer, Slavianoff, attempted to overcome them by substituting a metallic electrode for the carbon use, the electrode being fused together with the part to be welded by the heat of the electric arc.

Inspired by these early experiments, the advent of the twentieth century found an increasing band of workers in nearly every civilized country engaged upon this evasive problem of arc welding. The difficulties to be surmounted were considerable, involving the production and control of the electric current, and the production of satisfactory electrodes and fluxes with which to acomplish a homogeneous union at the point being welded.

There are two general methods of electric arc welding, one by the use of direct or continuous current, and the other by the use of alternating current. Much experimenting and development work has been done on both types of welding equipment in the past. The direct current system requires the use of a direct current generator, with suitable externable excitation and reactness to maintain a constant voltage across the arc. In addition to the generator a driving power is required, which is usually furnished in the form of a gasoline engine or an electric motor.

In the alternating current system the equipment is much more simple, requiring only a suitably designed transformer, having proper characteristics to maintain a smooth arc and give proper penetration into the work being welded.

Notwithstanding the common opinion about an electric arc, a machine can be built to operate with a given current in the arc, but having absolutely negative welding characteristics.

For reference I shall mention three types of arcs which are possible with the alternating current machines, all maintaining the same secondary current density.

"First. The arc having smooth velvety-like characteristics with very little penetration into the work, which leaves a weld with the metal only flowed on the surface.

"Second. The wild or blowing arc, which is very unsatisfactory for welding, but is very good for cutting purposes.

"Third. The smooth or steady alternating current arc, which penetrates deeply into the work melting the edges of the joint and flowing the metal from the electrode into the weld, causing a churning or purifying action in the deposited metal, working the impurities to the surface where they are consumed or flowed out by the action of the arc."

The last-named arc is the ideal arc for the welding of steel, wrought iron, malleable iron and especially cast iron.

Cast iron is a mixture of impurities, including pure metallic iron, silicon, manganese, carbon, sulphur, phosphorous and other elements.

Cast iron has certain peculiar characteristics. It is brittle and hard and cannot be bent or forged in any way. There are two main varieties of cast iron, viz. the "white" and the "gray." The former is the harder, and upon fracture shows a somewhat coarse grain. It is only used for rough castings. Gray cast iron has a finer grain and is used for castings which have to be subsequently machined. It is much softer than the white variety and not so brittle.

Cast iron is the most impure form of iron, as no attempt is made during the smelting process to prevent the entry into the molten mass of all the impurities contained in the ore, the fuel or the slag. Only about 94.5 per cent is pure iron. Carbon in iron always tends to harden it, which feature is, of course, sometimes required as, for instance, in tool steel. In practice where a carbon content is wanted, it is always added to the purified iron as a definite quantity. The brittle nature of cast iron is due to the silica, and in order to render the metal ductile, it is necessary to remove the silica together with the impurities, during which process the bulk of the carbon also disappears.

Owing to its brittle nature cast iron is difficult to heat at any time without danger of fracture. This circumstance renders cast iron the most difficult of the ferrous group of metals to weld. As it is frequently an impossibility to heat the whole casting evenly; there are sure to be strains set up due to unequal expansion to which the rigid mass of metal cannot yield. Hence, there is every feature inviting a crack, which is almost always the inevitable result. It is, however, a feature of electric arc welding that the intense heat is confined to the region of the weld, provided the arc length is not extended beyond approximately one-eighth inch during a welding operation. Therefore, by confining the arc heat to as small area as possible the expansion only takes place in a small portion of the metal, imposing a reduced strain upon the whole casting. This is the reason why it is so often possible to repair by arc welding such castings as pulleys, gears, machinery parts, large gas and steam engine bases, cylinders, fly wheels, automobile crank cases, oil pans, differential housings, transmission cases and last but not least automobile cylinder blocks.

It is important that where two pieces of cast iron are to be joined together, when it is necessary for the breaking strength of the weld to be equal to, or greater than, the original metal, a current density commensurate with the size and nature of the work should be employed. On very light work, current densities of 50 to 75 amperes, using $\frac{5}{32}$ and $\frac{1}{8}$-inch electrodes. On medium work, current densities of 75 to 150 amperes, using $\frac{1}{8}$ and $\frac{5}{32}$-inch electrodes. On heavy work current densities of 150 to 200 amperes, using $\frac{1}{8}$ and $\frac{3}{16}$-inch electrodes. If the current density is too high the weld will tend to burn, if the current density is too low, the metal will not fuse properly. It is necessary to thoroughly fuse the electrode with the metal being welded if a homogeneous union is to be expected. It is practically impossible

*Owen Electric Mfg. Co., Fayetteville, N. C.

to accomplish a good substantial weld with electrodes larger than $\frac{5}{32}$ inch, unless extreme care is exercised. Welds made on cast iron when larger electrodes are employed are poor welds.

In the welding of automobile cylinder blocks, crank cases, transmission cases, etc., we have found that it is unnecessary to chip or chamfer the fracture unless the casting in question is thicker than ½ inch. It is, however, necessary to thoroughly clean the fracture of paint, grease, rust and other foreign matter to dispense with "blow holes." On this class of work, experience has taught us to use current densities of 125 to 200 amperes. The majority of auto cylinder jackets are approximately ¼ inch thick and by using amperages of these values, namely 125 to 200, you have a high localized heat which accomplishes a quick fusing of the fracture and enables the operator to complete the welding operation before any great area becomes subjected to severe strains, thereby reducing cross cracks to a minimum. If the lower current densities are employed on repairs of this nature it requires a much longer period of time to bring the metals to a point of fusion, which of course, will subject a greater area to the expansion and contraction strains, which are very objectionable, as cross and longitudinal cracks are sure to appear or the weld will be "wasp nesty."

Malleable iron castings are formed in the same manner as ordinary castings, after which they are annealed in a special muffle furnace at an even temperature, for periods of a week or more, according to the degree of softness desired, this process enables the carbon, silica and other impurities to be largely removed, rendering the iron purer and more ductile. Good malleable castings can be heated and bent or even lightly forged where required. It is much easier to weld malleable iron than ordinary cast iron owing to its ability to withstand strains.

The welding of cast and malleabe iron in all positions, on the flat, vertical, or overhead, is accomplished with ease by an experienced operator, provided apparatus producing a suitable welding current is employed.

MAKING YOUR OWN ACETYLENE GAS

By A. G. Swanson, St. Paul Welding & Mfg. Co., St. Paul, Minn.

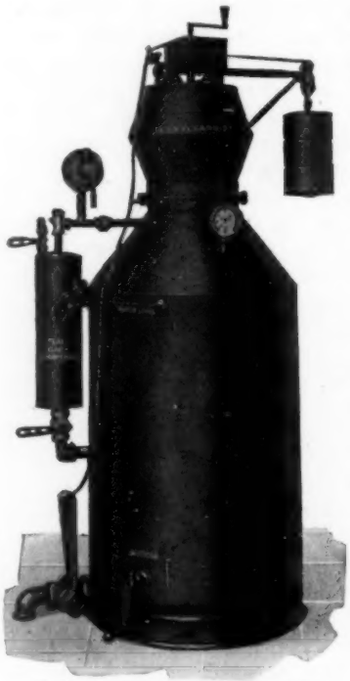
Acetylene in tanks is convenient and is the proper thing for the small shop or even the big plant where the torch is only occasionally lighted, but it is rather expensive where the gas is used all day, every day, all through the year.

There are several large plants in the United States which make nothing but calcium carbide. The fact that it is the only product of these companies emphasizes the tremendous consumption for the product. Great quantities are used in miners' lamps throughout the world, but the big use to which this calcium carbide is now being put is the making of acetylene gas for welding and cutting. Large generating plants are situated in most industrial centers and from these plants tanked gas is shipped to every nook and corner of every county in the country.

Now, doubtless, these generating plants will continue to increase in number, as they are very necessary institutions in the welding and cutting industry. But, while they increase their scope of activity, let us not lose sight of the fact that making acetylene involves no great skill, knowledge, or intricate machinery, while the compressing of the gas in tanks is quite an undertaking.

There are several makes of acetylene generators on the market and any purchased from established manufacturers may be depended upon. There are, however, various types and sizes of machines. There are machines approved by the Fire Underwriters and there are machines not approved. There are portable machines and there are those for stationary use. Each has its own use, and full information can be had from the manufacturers.

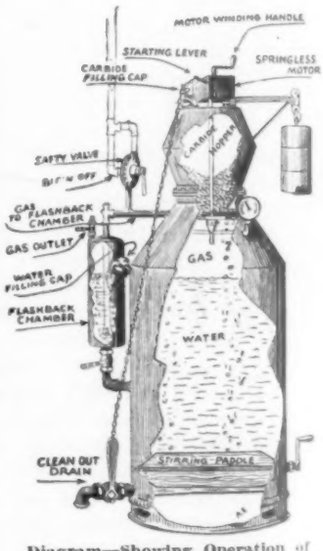
Acetylene is the gas that is produced when carbide comes in contact with water. For example; the lower part of the ordinary generator is filled with water; the chamber above is filled with carbide; with everything in readiness, the mechanism is set in motion and carbide is dropped into the water. Now as the carbide lumps are broken up by the action of the water, acetylene gas rises to the gas chamber directly above the water line. This generating of gas continues till a set pressure is reached, the dropping of carbide is then automatically stopped, and of course the generating of gas stops immediately after.



General Outside Appearance of Acetylene Generator.

Now the torches connected to the generator are lighted and gas is drawn from the gas-chamber. As the pressure begins to drop, the carbide feed is again automatically put in motion, and the dropping of more carbide renews generation of gas. Thus the generators is automatic; it makes gas only as the gas is drawn off, which is governed by a set pressure.

The selling price of acetylene in tanks varies according to consumption and also depends on the locality. The user of several tanks per month can, through making a contract, get a somewhat better price than the user of only one or two tanks per month. It is, therefore, difficult to get a good comparison of costs of acetylene in tanks as compared to the gas generated or made in the welding shop or welding department of the big plant. Another reason for not being able to determine the exact difference in costs of tanked acetylene and generated acetylene is through a variance in the cost of calcium carbide. The price of this also depends on location and consumption. We can though, take local figures on the cost of tanked acetylene and carbide and from this, we can make comparisons as regards gas expense, by figuring one hundred pounds of carbide as equivalent to 450 to 500 cubic feet of acetylene.



Diagram—Showing Operation of Acetylene Generator.

Any shop owner or superintendent can get exact figures for arriving at possible saving in generating acetylene requirements. The price of a generator can sometimes be saved in a year, or nine months, or even six months. At any rate the matter is well worth looking into. Every dollar saved is a dollar earned. Besides the direct cost in gas expense another important feature should not be overlooked. The user of a generator is assured of all the acetylene he needs when he wants it as long as he has carbide and water.

Hints for the Welder

WHEN YOU FIND a new way to do a hard job, or finish a particularly interesting weld, can you describe how the work was done? . . . . . Have you learned some little stunt every welder ought to know? . . . . . Write to us about these things . . . . . This department helps you welders to help each other. Write up your ideas any old way and just make rough pencil sketches . . . . We'll fix them up for publication.

OBSOLETE AIR COMPRESSOR CASTING ARC WELDED

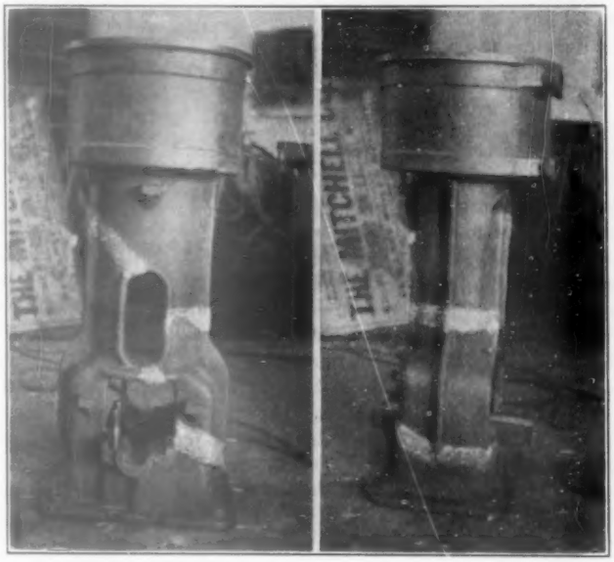
A casting which had formed the major part of an old steam driven air compressor was recently brought into the Chicago shop of The Mitchell Company for repairs. A lug had broken which so loosened the drive shaft that it pounded against the sides of the casting, breaking a large piece out of it and cracking it seriously in several other places. As the machine was over twenty years old, and that particular model was no longer manufactured, it was found that it would be impossible to replace the casting. The owners turned it over to The Mitchell Company and asked them to do their best on it. The job was not what a welder would call an unusually big one, but there was one phase of it which had to be watched with particular care. A steel slide fitted on the inside of the casting, and it could not be out of line even the smallest fraction of an inch. In other words, the piece had to be put back in place and the whole casting lined up just as it was when it was first assembled into the machine. Not only that, but it had to be just as strong as it was originally.

The casting was laid on its side on the welding table, the pieces were carefully put in place, and then a simple clamp was made to draw the cracks together and hold the broken piece in

Fig. 1. Casting Prepared for Welding. Note Studds Inserted Near Break.

position. As may be seen in the first picture, the clamp just consisted of a couple of flat strips of steel with holes drilled in the ends and then two rods of cold rolled steel threaded on each end. The strips of steel were placed over the ends of the casting as shown, and with the rods connecting them on each side the casting was drawn together. With everything lined up, the work of preparing for the actual welding was started. First the dirt and grease was cleaned away and the surface around the cracks ground off. Then it was marked for the steel studding which was to be put near the cracks. The work of putting in the studs was turned over to a mechanic who first center punched over all the marks. Then he took a portable electric drill and drilled out the holes for the studs, after which he tapped all the holes and inserted five-sixteenths studs. As there were some seventy-five of these put in, this job took over a full working day.

The actual welding of the casting took between five and six hours. Of course it could have been done quicker, but as an absolutely perfect job was required, care was more important than speed. There were some sixty-five inches of crack to be welded, and as one may see, that did not mean just running a bead over it. Most of the casting welded was quite thin metal



Figs. 2 and 3. Completed Job—Note the Bands of Weld Metal.

so that in the preparation veeing the crack had not been deemed expedient. The welding proceeded as usual in using the metallic arc on steel studded cast iron. The electrode used was a light coated steel wire and the welding machine was set for producing a 150 ampere current. As may be seen in the two photographs of the completed job, the welding formed a continuous steel strap about two inches in width over the entire line of the cracks. This steel, fusing with and held in place by the studs which kept it from pulling away from the iron, formed a very strong bond making the casting, as far as strength is concerned, just as good as it originally was.

When the machine was reassembled it was not found necessary to do any machining other than rub off a little burr with a piece of emery cloth. All the parts slid together perfectly, and everything was found to be in good working order.

WELDING THE ALUMINUM CRANK CASE

Most welders have their individual methods of procedure in doing various types of jobs, but the fundamentals are usually very much the same. In our April issue we described the welding of a broken aluminum airplane engine. The interesting phase of that job lay in the fact that the welder used a drawn aluminum wire for a filler, and did the job without special preheating. It will also be remembered that he used a liberal amount of flux in his work. The use of a good flux to remove the oxide is considered one of the fundamentals by most authorities on aluminum

welding, but at the same time they do admit that jobs can be done and have been done satisfactorily without its use. Some good welders always use a flux on aluminum, whereas some others never do.

Looking at the matter practically and with all fairness, it is not a question of using flux on all aluminum jobs or not using it, but rather it is a question of whether the particular type of job will be improved through the use of a flux, whether a flux is necessary to a specific job. Perhaps it is sometimes difficult to decide when a flux is necessary and when it is not. For example, in the case of the welding of the airplane engine the use of a flux was deemed very important by the welder. The weld was going to be subjected to a great number of stresses, and required the utmost strength possible to be obtained.

On the other hand a job was recently reported in which a first class welder did not choose to use any flux what-so-ever. He was repairing an aluminum oil pan taken from a truck engine. The crack in this case extended from near the middle of the pan in a semi-curve to the edge. The objective of the repair was to make the oil-pan leak proof. His procedure differed in several respects to that followed by the welder of the airplane engine. He used what is commonly termed the puddling method. The casting was set bottom up on the welding table, the edges of the pan clamped to two pieces of flat steel bars which rested on bricks. A city gas preheating torch was placed underneath, and the casting was well heated through-out before the job was begun. Then the welder cleaned off a small section around the crack, starting in the center of the casting. He used a wire brush and occasionally a file to get the surface oxide off. The casting had of course been washed in gasoline to remove the oil before the job was begun. With a patch four or five inches long cleaned off, he next took up his torch and using the hot neutral flame and a small steel paddle, he dug out a rough vee in the soft aluminum, and then maintaining his heat over this portion he filled in and built up with a cast aluminum rod. When he had added sufficient metal he again picked up his paddle and used it to work the metal in, shape it up, and smooth it off. Then he repeated this procedure on another section the same size working toward the edge. As the crack was about twenty inches in length, it took four of these steps to finish the repair. The finished job looked very well and showed no signs of bad places after it had cooled.

The case cited above just goes to show that some types of aluminum jobs can be welded without the use of a flux. That fact is worth keeping in mind, but at the same time one realizes that the above job could have been done with the use of flux, and that for the inexperienced welder it would have perhaps been better to have used it.

OVERCOMING DISTORTION IN WELDING

By Paul Ross*

It has been our experience at the General Iron Works, that when an engineer is called on to design a new machine or to redesign an old one, he will do well to ask himself the question, "Can I gain by welding some part?"

About four years ago, the Dorr Co.'s engineers began to consider welding. At that time no welding was done on any of the "Dorrco" line. All steel members were joined by riveting or bolting. At this date, practically every item in the "Dorrco" line has some welding used some time in the course of its manufacture. Progress in this direction has been made, and is being made, along very conservative lines. No part is welded until tests have been made to determine the absolute reliability of the part in the service for which it is intended.

Quite recently, the Dorr Co. designed and sold a classifier much larger than any previously built. Owing to the size of the bowl the rakes had to be designed for a very great overhang. The total length of the rakes is 41 ft., and they are supported by two hangers one of which is only a few inches past center. The stringers were 8-in. channel sections and the blades of ⅜x5 bar iron 3' 1" long were joined with 2"x3"x¼ angle clips, welded. The length of the rakes made it necessary to joint them in the center for assembly purposes. A splice bar was welded to one section and bolted to the other.

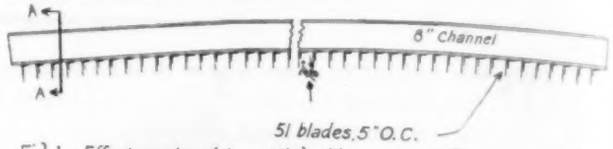


Fig. 1 *Effect produced by welding with no control. The curvature is greatly exaggerated to make same more readily apparent.*

Our welding department was faced with the problem of welding the angle clips along one flange of the 8" channel and producing a straight assembly. It was known that some distortion would result, but we were unable to determine the amount by

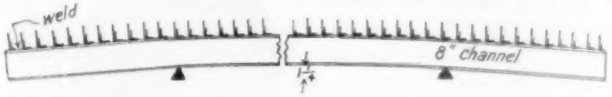
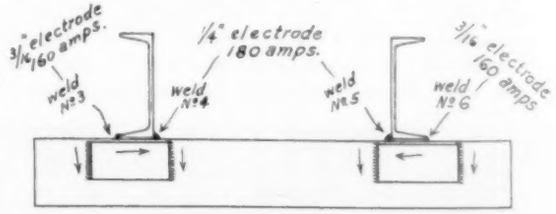


Fig. 2 *Channels were supported in two places while the ends were clamped down. The curvature is exaggerated, but is more easily seen. After welds 1 and 2 were made, the rake was turned over and the clamps applied in center while the ends were supported.*

calculation. One complete unit was assembled with no effort made to control the edgewise deflection. A procedure had been decided on which prevented "buckling" or side-wise movement (see Fig. 3). When all welding was complete and the assembly had cooled, it was found that the channels had an even curvature from end to end which raised the center about ⅞" when the rake rested on level surface. (See Fig. 1.)

In order to attain this shape, the lower flange must contain



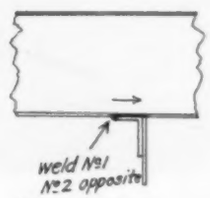
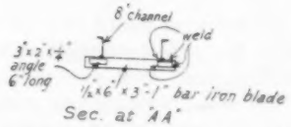


Fig. 3



stresses sufficient to compress the lower portion of the webb, and the ultimate distortion represents a point where the stresses balance each other, *i. e.* the flange is in tension and the webb is in compression.

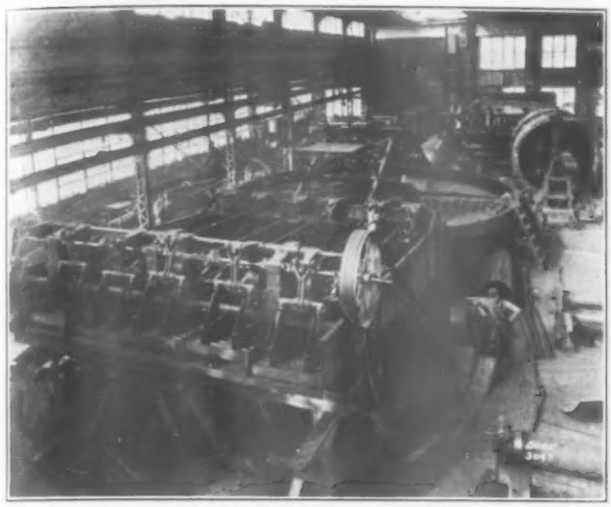
It was assumed that if welding were performed while the lower flange is in proper tension, the metal which is above will stretch enough to compensate for later contraction. No equipment is available for stress measurement, so we were forced to do some "good guessing."

Referring to Fig. 1, it appears that the resistance to compres-

*Welding Engineer, General Iron Works, Denver, Colorado.

sion in the webb would cause movement to cease when only a part of the tension stress in the lower flange has been relieved.

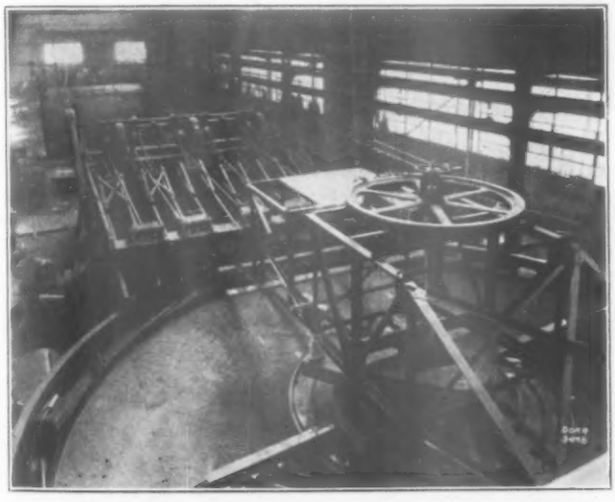
A second pair of the channel stringers were prepared for weld-



Discharge and Bowl Type Classifier.

ing by clamping them down in such manner as to produce a deflection 50% greater than that which had been produced by welding. (Fig. 2.)

The welding procedure was adopted with the idea of eliminating stresses other than that just referred to. The angle clips were first welded to the blades. This produced a curvature in the blades, but it was not thought worth while to try to pre-



Front End of Bowl Type Classifier.

vent this inasmuch as a man was able to straighten the blades at the rate of 60 per hour. In Fig. 3 the welds are numbered and were made in that order. Welds Nos. 1 and 2 were made while the rake was in the position shown in Fig. 2. The rake was then turned over and clamped to the same position. Welds 3 and 4, and 5 and 6 were then made. All welding was done in the flat position. Two welders worked together, beginning at the outside and working toward the center, welds 1 and 2 on the same blade were made at the same time. On welds 4 and 5 a ¼" electrode was used, while on 3 and 6, a $\frac{5}{16}$" electrode was used. Nos. 3 and 4 were welded at the same time, as were 5 and 6. The direction of welding is indicated by the arrows.

This procedure proved to be entirely satisfactory. There was no buckling at all, and in fact some pretty crooked members were straightened. The rakes were as straight as those previously made by riveting and are much more rigid. We believe that these welded rakes are very nearly free of strains. There is no reason to suspect locked-in stresses.

METAL DOORS FOR A WELDING BOOTH

By J. C. Coyle

In constructing a metal booth for welding car journals at the Denver shops of The Denver & Rio Grande Western, it was found necessary to equip one end of the booth with doors which would confine the light and yet permit the quick and easy movement of the axles into the booth. A pair of old rails are used as a track and as the axles are completed others are rolled in to the welder.

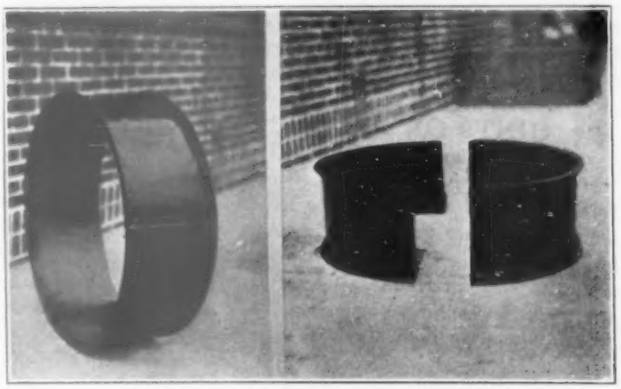
The new booth is six feet high and twelve feet square and is

Sliding Doors—One Raised to Show Clearance.

built of ⅛ inch sheet metal on a frame of 1 inch angle iron. The double doors which are made of the same material, are hung to swing outward. The lower half of each door is so made that it will slide up on the inner surface of the upper half, and when raised it can be held up by hooks suspended from the top. Handles are provided on each section by which to raise them. When these are up the axles can easily be rolled in. A notch in the bottom of each lower door section enables them to fit over the track. The lower halves slide up and down in grooves formed by pieces of angles which are fastened to the angle iron frame of the upper sections. A long 1½ inch angle is used to bar the doors fitting in hooks at the sides and the middle of the two doors.

A SHEET STEEL FORM FOR CONCRETE PEDESTALS

Contractors and builders will be interested in the use of inexpensive welded sheet steel forms for certain types of concrete work. The form illustrated was designed by a Long Island contract weld-



Left—Welded Form Assembled. Right—The Two Parts of the Form.

ing shop for a concern which builds gasoline filling stations. It is used in the construction of concrete pedestal bases on which gasoline pumps are mounted. The usual practice in forming pedestals, or

bases, calls for the construction of a wooden form by a carpenter.

The sheet steel form illustrated possesses several distinct advantages over this method. In the first place, it does not stick to the concrete upon removal after the mixture has hardened. The wooden forms do this occasionally and have to be hammered loose, sometimes taking part of the concrete with them. The sheet steel form can be removed by simply loosening four bolts. The chief advantage, however, lies in the fact that the form can be used over and over again. Its sturdy construction assures long life.

These forms are fabricated by the oxy-acetylene process quickly and economically. They are made in two sections which, when bolted together, form a ring 30 inches in diameter. Each section is made by tack-welding 14-gauge sheet steel top and bottom to two pieces of 1x1x⅛ inch angle iron which have been bent so as to form semi-circles. Holes for ⅜-inch bolts are cut with the blow-pipe in the ends of the angle iron pieces which project and form lugs for bolting the two sections together.

A STURDY PAIR OF CARPENTER HORSES

Most plants or shops can use a pair of carpenter's horses and indeed few places are without these handy accessories. The trouble with most carpenter's horses, however, lies in the fact

A Pair of Carpenter Horses Easily Made by Any Welder.

that they are usually made of wood and have a tendency to break or spread after they have been subjected to any hard usage.

The plant welder of a large Eastern shop, realizing these facts, constructed a pair out of some scrap angle iron. The finished product was an agreeable surprise to the carpenter's gang and a great improvement over the wooden ones that had been used in the past. It was a simple task to weld these pieces of scrap together. The accompanying illustration clearly illustrates the construction of the horse and the location of the welds. The pieces were all welded with butt-type joints and a small amount of welding rod added for extra strength.

HINTS ON PRODUCTION WELDING

By George T. Kerr*

(Note—The full possibilities of welding on production jobs can only be realized by studying the technique of each process so that the opportunity to use any one process, or more than one process, in a single assembly, is quickly recognized. The better the processes are understood, the easier it is to devise jigs, and special procedures to facilitate production. The details given in this discussion form a production system by means of which a remarkably serviceable product is obtained. The identical principles could be adapted to many other similar products.—Editor.)

The piece shown in Fig. 1 is a welded oil manifold, and when finished is a solid leak proof job, light in weight, all parts accurately assembled, and no chance of anything working loose as would be the case if the various units were screwed together. This manifold is assembled to the inside of the Hall Scott 5 in. by 7 in. Marine engine Model No. 132-157, rated at 175 H. P. Its function is to supply oil under pressure to the main bearings.

In Fig. 2 we have the various units. A is a piece of ¾ in. by 16 gage seamless tubing, about three feet long. B is two pieces of ⅝ in. by 16 gage seamless tubing one bent right hand and the other left. C is two flanges that assemble to

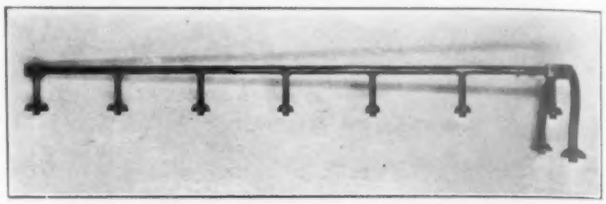


Fig. 1. Welded Oil Manifold for Hall-Scott Marine Engine.

pipes B. Parts E and F are the two end blocks, E located at the straight end of the assembly, and F at the bent end. The material is 1 inch square cold rolled steel. They are drilled to receive the pipes and both are tapped with a pipe thread at their outer ends. Parts G are seven flanges drilled to take the short pipes H. Part H are the seven short pipe ½ inch diameter by 12 gage and 3¼ inches long.

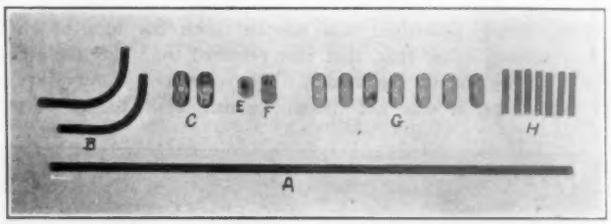


Fig. 2. Various Units of Oil Manifold.

The various units are assembled in the jig (See Fig. 3) with the flanges turned up, square blocks E and F are tacked to pipes A and B and the tubes H are welded in their respective positions. The jig is now turned over (Fig. 4) and all flanges are brazed. The flanges are made of malleable iron. If enough heat were used to weld them in place the grain of the iron would become coarse and there would be danger of breaking from unven strain in the bolting at the final assembly.

Figure 5 shows the jig taken apart to remove the manifold. The blocks E and F were only tacked and are now com-

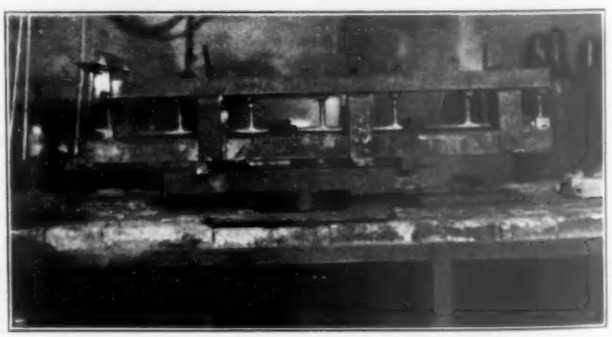


Fig. 3. Units of Manifold Assembled in the Jig.

pletely welded, it being easier and quicker to do this out of the jig. The jig is made of two pieces of channel iron and a few pieces of ½x2 machine steel. Dowel pins are used in the U pieces to locate both parts of it in proper relation to each other. When assembling the jig the three pieces with the bent handles (Fig. 5 and also top Fig. 3) are threaded studs to hold the jig together. Dowel pins are inserted in the half of the jig that receives the flanges to locate them in their proper rela-

*Hall Scott Motor Co., Berkeley, California.

tion with each other. Holes are also drilled through this half allowing part of the pipes to extend below the flanges. The flanges are assembled to the manifold $\frac{1}{8}$ inch from the pipe ends so that the pipes can enter drilled holes in the crank case and when bolted in position be less liable to leak.

Fig. 4. Jig Inverted For Brazing Operation.

Figure 6 is a turn table. A large ballbearing that had outlived its usefulness in a machine tool and was pressed into service. The outer race was tacked welded to the lower plate and the inner race to the upper channel iron. The turn table

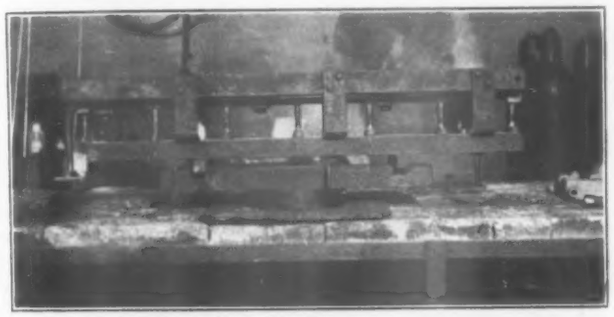


Fig. 5. Jig Apart and Manifold Ready for Final Operation.

makes the work of the welder much easier as he can swing the jig into any position quickly and easily. Such a turn table can be made by any good welder and is a wonderful help to production.

A drilling operation is now necessary through the seven ½ inch pipes H opening a hole through one wall of pipe A. The burrs formed by drilling are now removed from the inside

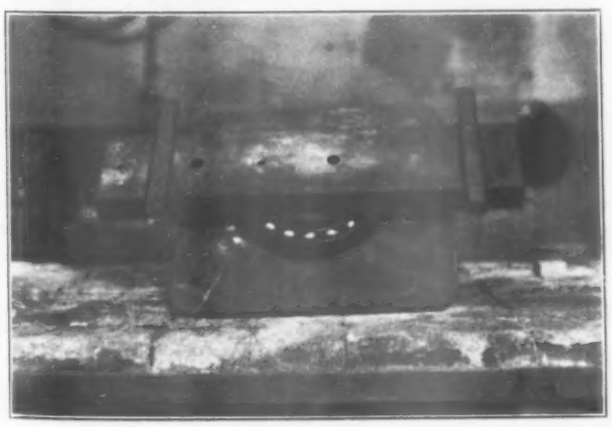


Fig. 6. Turn Table for Supporting the Jig—An Easily Constructed Device.

of the pipe. The manifold is inspected and water-tested at 200 pounds pressure. Fig. 6 shows the water test fixture, means of clamping, rubber gaskets, hose connections, with the pressure gage shown on the fence.

After inspection the manifold is pickled in a sulphuric bath to loosen all flux, oxide, etc., from the inside of the tubing. The acid is neutralized, the piece thoroughly washed and oiled, and it is now ready for use.

This manifold requires about two and one-half hours, to fabricate and test. We make many other welded pipe assem-

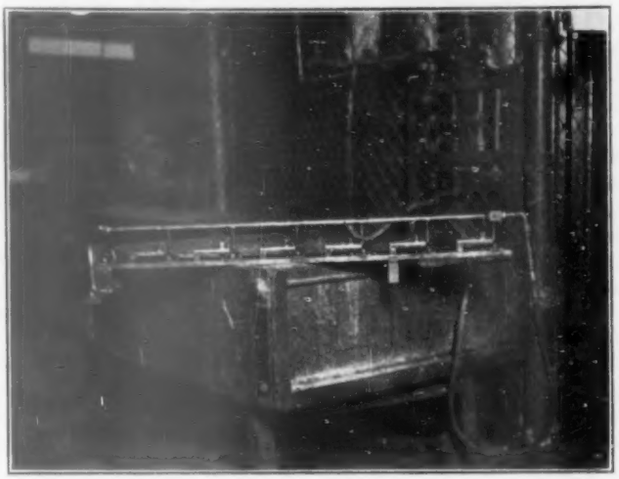


Fig. 7. Manifold Being Water Tested.

blies, some welded, some brazed, and some silver soldered, depending on the material used and the conditions under which they are used.

THE AMERICAN WELDING SOCIETY SPRING MEETING

The two principal features of the annual meeting of the American Welding Society, that is the program of papers, and the annual spring banquet, were so well prepared this year as to make it difficult to say whether the program committee or the banquet committee did the best job. The technical sessions were well arranged and at them there were presented some splendid papers on up-to-the-minute welding subjects. A particularly interesting session was the one given over to the subject of training operators. At this session men who had had experience in training welders for a number of different kinds of requirements described their own methods and exchanged ideas on subjects pertaining to welding instructions.

The banquet which was held Thursday evening April 25th, surpassed in size all previous annual banquets, there being a total attendance of over two hundred sixty men. In addition to an excellent entertainment program considerable amusement was furnished by the distribution of souvenirs and the drawing of prizes donated by members of the society. The following firms contributed souvenirs and prizes for this event: Union Carbide and Carbon Corpn., Westinghouse Elec. & Mfg. Co., Metal & Thermit Corpn., K-G Welding & Cutting Co., Electric Arc Cutting & Welding Co., Elkon Works, Inc., General Electric Company, McGraw-Hill Publishing Co., American Chain Co., Air Reduction Sales Co., U. S. Gauge Co., International Nickel Co., William Wrigley Jr. & Co., Joseph Dixon Crucible Co., Wade & Butcher Oakite Co., Jos. T. Ryerson & Son Passaic-Bergen Welding Works.

CHICAGO SECTION ELECTS OFFICERS

At a recent election of officers, held by the Chicago section of the American Welding Society, Mr. H. E. Gannett of the Chicago, Burlington & Quincy Railroad was elected Chairman for the coming year. Mr. Gannett is a prominent authority on railroad welding subjects and has contributed generously to the progress of the Chicago section. Mr. J. W. Turner of the Pacific Steel Boilers Corporation, Waukegan, pioneers in the application of electric welding to the production of boilers, was elected Vice-Chairman. Mr. M. S. Hendricks, editor of the Acetylene Journal, was re-elected Secretary and Treasurer.

MACHINE CUTTING*

Machine cutting was first introduced industrially by Dr. Wiss, Griesheim, Germany, about twenty years ago, but has made enormous strides only during the last five or six years. Nevertheless, it was taken up almost from its start by Mr. J. F. Madgett, Superintendent of the General Electric Company in Schenectady, and his assistant, Mr. Proper, who developed machines for their own purposes, and even made their own torches. Few people know about the wonderful work they accomplished, and their names never appeared in print.

The Davis-Bournonville Company (now Air Reduction Company) also started early to enter this field, constructing quite a number of machines for different applications. Finally the General Welding & Equipment Company have come out with very simple machines for exact reproduction work and specially designed for mass production and for cutting pieces of practically unlimited length with one setting.

However, as is usually the case, the introduction of machine cutting has been rather slow. Nevertheless, a decided step forward was made several years ago by the Oxweld Railroad Service Company by putting up machines in railroad shops where they gave service. Very quickly the possibilities of replacing forging by cutting were made apparent, and within a very few months one machine alone was not sufficient any more. At the same time the forge shop crew could be reduced to one-third, and also much valuable floor space was set free for other purposes. Very interesting figures about some of the work in railroad shops, together with sketches of the pieces cut, were given in a talk by Mr. Wiggin, foreman of the forge shops in Billerica, Mass. (See *Acetylene Journal*, June, 1928, issue.)

Much discussion has floated around for some time that machine cutting could affect the faces of the cut pieces to an extent so as to weaken the strength. After quite some investigating, it was found that responsible pieces of high-quality steel, when heat-treated before and after the cutting operation, would eliminate all possible dangers. Therefore, the Oxweld Railroad Service Company took a second step forward and put up in the railroad shops, together with the machines, the necessary ovens.

It had been generally accepted that machined—and not cut—pieces had all the elements of safety of the original material. It was at least taken for granted that machining would not affect the pieces. This, however, does not seem to be the case always. Much depends on how much material is milled off at once—in short, to how much strain the pieces were subjected during high-speed machining. It may, then, often show that a heat-treated piece cut with gas withstands higher strains than a machined but unannealed piece.

After these questions had all been settled, the objection against producing responsible pieces by cutting died down and the railroads went quickly ahead, restricted their forging and turned over to gas cutting on a large scale. They also started to manufacture many new serviceable pieces out of scrap. In fact, some railroads have already special reclaiming shops where machine cutting is one of the outstanding features.

Although the industrial field lagged somewhat behind at first, the impetus which originated within the last two years has already developed into a rather remarkable field of application. This field is known as replacing castings by steel elements cut out to shape. The commercial benefit is that steel only costs about one-third compared with cost of castings, and that only one-half of the weight is needed to produce the same strength. In this way the cost of raw material can be reduced from 6 to 1. Now this is a saving which no other procedure has made possible within quite some years. No wonder that machine cutting was quickly taken up and as usual first by our far-seeing electrical companies. One remarkable example is the General Electric Company at Lynn. In August, 1927, they installed their first shape-cutting machine. Early in 1928 they put up several more, together with all kinds of bending and welding machines, to prepare for mass production of motor and generator frames, turbine parts and a wide range of other pieces. They closed their large steel foundry—a building of about 600 feet by 300 feet—and now only need one-quarter of the floor space, the remainder of the valuable building being now available for other purposes.

In a short yearly survey it is only possible to give a few high spots. However, there has been a paper read by Dr. A. Krebs in December, 1927, giving more details about replacing castings by steel elements for all those who want some more information.

In Europe, machine cutting also has developed new momentum, and, aside from quite a number of cutting machines for specific and odd work, the well-known Griesheim Autogen Works have added to their lines the shape-cutting machines of the General Welding & Equipment Company of Boston.

Hand in hand with the practical development of machine cutting, researches regarding machine cutting have kept in line. At the September, 1928, convention of the German Acetylene Association one exceedingly complete paper about cutting and machine cutting was read by Dr. Wiss, Griesheim, which can be recommended to all those who take a deeper interest in this matter.

Reprinted from the Report of the Oxy-Acetylene Committee of the International Acetylene Association, 1928.

WHEN NIGHT WORK IS NECESSARY OR ADVANTAGEOUS

The use of a portable acetylene light as an emergency measure is by no means confined to fire departments, wrecking crews or similar organizations. Due to the present industrial expansion there is need today for such a light in many industries. Road contractors find the portable light a handy aid in night work where contracts must be completed rapidly or where a bonus depends upon finishing the job within a certain specified time. Excavating contractors keep their steam shovels busy on twenty-four hour schedule by means of portable flood lights. They find the loaded trucks can make better time at night through deserted city streets. Many building contractors use the portable light

Flood Lights Speed Construction Work

on work which precedes the installation of electric wiring in the building. Such work may include laying a cement floor at the street level, as is shown in the accompanying illustration, or jobs undertaken while the steel frame work is progressing skyward.

The needs of these men have been successfully met by the use of portable acetylene flood lights. These lights combine many distinctive features. They are extremely portable. Skilled labor is not required to operate them. When the light has been put in operation it requires no further attention until the charge is exhausted. The beam is far reaching, and penetrates fog and smoke to a remarkable degree. It operates efficiently in rain or snowstorms and under torrid or frigid conditions. The steady acetylene flame resists winds of almost gale force. In view of these features several types of portable acetylene flood lights are widely adopted as standard equipment by those who find night work necessary or advantageous.

WELDING HAS SAVED THOUSANDS OF DOLLARS AT THE MOTION PICTURE PRODUCTION STUDIOS

The accompanying illustration taken in the machine shop of the Warner Brothers' Motion Picture Production Studio at Hollywood, California, gives an idea of the versatility of the welding torch when used in connection with motion picture production work.

As an industry, the motion picture studios embody large quantities of scientific apparatus, particularly so, since the advent of the sound or talking pictures. There is the ever present necessity of preparation for immediate repairs as well as the necessity for quick fabrication of all manner of devices and accessories. Aside from the scientific apparatus, the studios maintain and service a large fleet of pleasure vehicles and auto trucks and portable electrical apparatus including gasoline driven electric generating units. In a word, the motion picture studio, particularly one as large as the Warner Brothers Hollywood Studio, in reality, is a large mechanical plant.

A View of the Welding Department in Machine Shop of the Studio.

Prior to the adoption of the welding torch in their own plant, it was necessary for the studio to either call upon the nearby machine jobbing shops or replace broken or injured equipment with new. Such a practise often necessitated expensive delays and held up production for days at a time.

Now, with several welders constantly on duty and with adequate welding equipment of every sort, maintenance and repairs are speedily taken care of and, at the same time, the operators of the studio have gradually adopted welding for the fabrication of new equipment. In fact, the welder, at this particular studio, has become an artisan, capable of reproducing out of metal, with the aid of the cutting and welding torch, almost any desired shape or commodity.

TRAINING WELDERS*

One of the most significant developments in the last year or two in the welding field is the attention that is being given in this country to procedure specifications in important welding operations. One of the prime requisites of proper procedure specifications is having qualified operators for the work to which they are assigned.

It is not sufficient to take welders who have had five years or more experience and conclude that they are expert for the work in hand. It is now recognized that a welder who may do excellent work on thin material will not necessarily be able to, without additional training, make good welds on thicker material. The position of welding is also of importance. For example, a man may do 100 per cent work on plate welding in a "flat position" but will make poor welds on pipe line work where some overhead welding may be required.

There is a tendency to classify welders and give them work for which they are particularly fitted. For example, in pipe line welding a welder may be able to do 100 per cent work in making joints with the pipe turned around to provide an easy position for welding, but he may utterly fail to make a good "bell-hole" weld.

It is, therefore, essential that a welder be tested for the work which he is to do. These test specimens should be made up of material of the same thickness and with the same preparation which the welder will encounter in service. If vertical welding will be required of him, some specimens should also be made in this position. The American Welding Society has given considerable attention to this important matter and a report of this subject was published in the May, 1928, issue of the Journal of the Society.

The importance and necessity of qualifying welders by a suitable check test cannot be overemphasized. It has often been said that a chain is no stronger than its weakest link. A well set up organization will see to it that proper materials and apparatus will be supplied. It can also be reasonably expected that the designing branch will work out designs particularly adapted to welding both from the standpoint of economy and dependability of the welds if properly made. It is, therefore, only reasonable to expect that the same care will be taken to qualify the welders for the work which they are expected to do. The designing department will then have accurate knowledge of what may be expected for a particular joint in service, because they will know that the welders employed are capable of repeatedly producing a product of uniform known strength. It then remains for the regullatory or supervising force to see to it that such welds are produced.

As to the exact mechanism for training of welders, this has been worked out with a great deal of care by a number of the important manufacturing companies, trade schools and by the American Welding Society working in cooperation with the Federal Board of Vocational Education. The fundamentals in which oxy-acetylene welders should be trained are well known.

Any manufacturer who contemplates the use of welding to a marked degree in his production work, would do well to provide the means for the training of apprentice welders. In this way he will be assured of a steady supply of trained welders for the specific tasks which he needs in his production work. It can be readily seen that welders trained for a limited number of specific tasks will not require as long a training period as welders who will be expected to do general work in a large variety of fields.

When complete control is obtained through proper procedure specifications, welding will advance rapidly and will have the confidence of conservative engineers and regulatory bodies.

Reprinted from the Report of the Oxy-Acetylene Committee of the International Acetylene Association, 1928.

THE NATIONAL METAL EXPOSITION TO BE HELD IN CLEVELAND

The Eleventh National Metal Exposition will be held during the week beginning September 9th and ending on the 13th, 1929, and will take place in The Public Auditorium, Cleveland, Ohio. Accompanying the National Metal Exposition will be the meeting of the National Metal Congress. Simultaneously with these, The American Welding Society will hold their National Fall Meeting, The American Society for Steel Treating will hold their Eleventh Annual Convention, The Iron and Steel Division of The American Society of Mechanical Engineers will hold their national fall meeting, and The American Institute of Mining and Metallurgical Engineers will hold the national fall meeting for their Institute of Metals Division and their Iron and Steel Division. Those interested in further details regarding these meetings may obtain them by getting in touch with the Managing Director, Mr. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio.

PASSAIC BERGEN WELDING WORKS PIPE WELDING SCHOOL

On Wednesday, April 17, 1929, the Passaic Bergen Welding Works, having welding shops in Paterson, Hackensack and Clifton, N. J., with main officer at Clifton, gave a dinner to the first class of pipe welders turned out by the school run by that company.

The local plumbers association of Passaic County asked to have this school started. The first class had twenty-four students, the second class started April 19, and the advanced class on pipe welding will start in September. This class will be made up of students from the classes up to and including the class that finishes in July.

This class will start in on overhead and vertical pipe welding, and in the meantime three students of the early class are to attend the school one night each week, until the advanced class is put on overhead and vertical welding, to keep in practice and improve on their welds.

An interesting exhibit at the dinner was the sample welds made by the students. These consisted of welded pipes, two welded in nozzles, and a seam weld the length of the piece. Each weld was tested under pressure and the number of leaks recorded.

Six jobs showed no leaks, and ten only, one or two small pinhole leaks. Of the ten that showed leaks only two could not be closed by peening. Prizes were awarded to the three students having the best looking welds that did not leak. All the jobs were very good.

Mr. Frank Leslie of the Welders' Service and Supply Company, Jersey City, was the judge. Mr. Leslie, for a number of years with the M. W. Kellogg Company of Jersey City, made a very good judge because of his experience with pipe welding. He was in the sales department of the K-G Welding and Cutting Company up to April 1st, and has now taken on the K-G line as a distributor.—*From International Acetylene Association Forum in Acetylene Journal.*

GAS PRODUCTS ASSOCIATION SUMMER MEETING ANNOUNCED

At a meeting of the executive committee of the Gas Products Association, held April 25th, in the office of the Association at Chicago, it was decided to hold the summer meeting of the Association at the Golfmore Hotel, Grand Beach, Mich., on Thursday, Friday, and Saturday, June 20th, 21, and 22nd. Grand Beach is on Lake Michigan, directly opposite from Chicago, one hour and fifty minutes time on the train and about an hour and a half drive in an automobile from Chicago. It is a very central location and easily accessible for most of the members of the Association. The Golfmore Hotel provides all the comforts and conveniences necessary as a convention location and is so situated as to furnish maximum opportunity for outdoor sport. Recreation available at the hotel includes golf, boating, swimming, horseback riding, bathing and tennis. A special program for the golfers is being prepared by a golf committee under the able leadership of E. L. ("Rego") Mills, sales manager of the Bastain-Blessing Company, Chicago. Mr. Mills has served notice on the golf players that they need not be worried by such common ailments as fallen arches, astigmatism, blisters, sunburn, loss of memory or halitosis, because the prize competition will be conducted under regulations which favor the poor player, so that he will not have to remember what alibi he picked out for that particular day and will be able to keep his mind on the game. The details of the business end of the program have not been arranged, but it is expected that they will be ready for publication next month. Reservations and requests for information concerning the convention should be addressed to the Gas Products Association, 333 North Michigan Avenue, Chicago, and golf players expecting to attend are requested to file application for a place in the competition with Mr. E. L. Mills, care of the Bastain-Blessing Co., 246 East Ontario Street, Chicago.

OBITUARY

Mr. Frank B. Toombs, general sales manager of the Chicago Steel and Wire Company of Chicago, died at his home in that city, April 15, the result of pneumonia complicated with pleurisy.

He was one of the founders of the Chicago Steel and Wire Company, being a Director and Treasurer at the time of his death, as well.

Mr. Frank B. Toombs.

The Company was organized in 1914 producing wire specialties. About ten years ago when the welding wire manufacture was started, Mr. Toombs also took on the sales of that and related products. Having been in the business during the early part of the expansion of welding he was very well known throughout the steel trade and metal manufacturing industries.

Throughout the welding industry he was noted for his abundant energy and gained friendly personality.

Frank B. Toombs was born in Marquette, Michigan, May 24, 1893. His father, Robert Toombs, was Auditor and Comptroller of the Soo Line Railroad. He attended the University of Minnesota and was a member of Delta Upsilon Fraternity. He was a World War veteran serving in France with the Medical Corps. He was married, his wife and one son surviving him. Burial was in Milwaukee.

PENNSYLVANIA CITIES MAY NOW WELD BUILDINGS

An increase in the use of welding in the construction of buildings in the state of Pennsylvania is foreseen as a result of the passage by the legislature of that state, of a law which allows this type of construction to be used in first-class cities. The new law gives in detail a building code for cities of the first class and in this code is a section giving permission to commissioners of buildings in such cities to adopt welding as an erection method.

According to Frank P. McKibben, nationally known authority on the use of welding in building construction, such legislation is needed throughout the entire country. "This method of construction," says McKibben, "has been successfully applied to at least 50 buildings in this country, varying in height from one to eleven stories, the one containing the greatest amount of steel being a factory building constructed by the General Electric Company in Philadelphia. So many successful applications have been made that the process has been removed from the realm of experimentation and its usefulness is established as a satisfactory tool for constructive effort, not only in structural work but also in many other fields."

Numerous municipalities, according to McKibben, are at present

revising their building codes to permit the erection of welded buildings. He mentions two model codes now available, one recently adopted by the American Welding Society and the other, that of the Pacific Coast Building Officials Conference. The latter is a society whose members are building commissioners and inspectors in western cities, organized to draft a uniform building code. This uniform code, although in existence but two years, has been adopted by more than 42 municipalities in the west and south.

As the Pennsylvania law is applicable only to cities of the first class, municipalities below that grade are free to adopt their own codes.

PORTABLE EQUIPMENT OF CINCINNATI WELDERS ATTRACTS ATTENTION

A part of the equipment of the Welding Service Co., 1130 Gilbert Avenue, Cincinnati, Ohio, is the portable engine driven electric welding outfit, shown in the accompanying illustration. This firm offers complete service for electric and oxy-acetylene welding, either at their plant or on the premises of the customer. Mounted in front of the arc welding apparatus is a complete oxy-acetylene welding and cutting equipment so arranged as

Truck With Equipment Mounted for Immediate Use.

to keep the tanks upright at all times. The equipment is all coupled up and ready for immediate action as soon as the portable shop reaches the job. Mr. W. T. Harbin is the manager of this progressive welding shop and his up-to-date methods of equipping and going after business have attracted considerable attention locally. A short time ago a photograph and complete description of his service was printed in one of the Cincinnati newspapers.

LARGE WAREHOUSE ARC WELDED

A large warehouse has been recently completed for the Capital Rice Mills, Sacramento, California. The frame of this building was built of structural steel and all assembly and erection con-

Erected in 27 Days by Arc Welding

nections were arc welded. All the work of fabrication was done on the concrete floor of the building. Two Westinghouse welding machines were used on the job. The labor just consisted of two skilled welders, four workmen, and one skilled foreman. These men were able to erect this large structure in 27 working days. The warehouse is 200 feet long by 100 feet wide with a 10 foot lean-to on the track side. The height from the floor to the bottom part of the truss is 14 feet. The simplicity of the entire structure is worth while noting. Although the photograph does not show the design the roof trusses, they can not be termed as complicated. They are fifty feet long, two of them being used to span the width of the building with their inner ends meeting on a set of center columns down through the middle of the building. In other words the frame work of the warehouse consisted merely of three sets of columns and two sets of roof trusses all of welded construction.

HOLD MEETING FOR JOB WELDERS

A meeting of the Chicago section of the American Welding Society which was held May 3rd, was arranged for the special benefit of managers of job welding shops. Several talks were prepared relating to new processes and new methods of getting business for the job shop. A very interesting talk on the use of hard facing materials was given by Mr. E. F. Smith, Chicago District Manager of the Haynes Stellite Company, and a talk on the welding of copper and its alloys by Mr. W. C. Swift of the American Brass Company. Both these talks were followed by extensive discussions of welding problems involving the use of these materials. This is the last of the spring meetings on the program of the Chicago section. The next meeting of the section will be held on Friday, October 4th.

NEW FIRM OF CONTRACT WELDERS ORGANIZED

A very ambitious plan of operation has been instituted by The Pipe-Weld Company, a newly formed organization with headquarters at 701 Spring Arcade Building, Los Angeles, California. This company, which brings together, under one head, several of the Pacific Coast's leading authorities on arc-welding, plans to serve the entire southwestern part of the United States. At present through the establishment of branch offices, each fully equipped, it is in a position to serve all parts of the state of California, from Fresno to the Mexican border.

The Pipe-Weld Company may be considered as another step ahead of the pipe-line welding contractor, as this company operates only as welders and will not include in their operations, trench digging, back filling, or the furnishing of any materials other than those used in the actual welding operations. They will specialize entirely in arc-welding and, at this particular time have fifteen portable arc-welding outfits in the field which, with but a single exception, are all the Shrader Electric Company's welding equipment mounted in International Automobile Trucks.

With a well equipped laboratory and an engineering personnel capable of rendering any necessary research or development service, this company proposes to further its operations by selling the idea of the more extensive application of arc-welding. Individually, the several members of the new organization have many accomplishments to their credit and, by their combined efforts through a central organization, they plan to go still further in their development and research work. So far, this company has centered its efforts on pipe welding in its many branches, but later they expect to enter the field of structural welding.

The following tests, made in this company's own laboratories, give a good conception of the wide range of applications in pipe-line welding:

TENSION AND PRESSURE TESTs.

(1) 4" Leaky line, carrying 320 lbs. oil pressure, dirty, rusty pipe—four extremely leaky joints welded while leaking. Results: All leaks stopped with no trouble; pressure raised to 1,150 lbs. No leaks. Air test 500 lbs., no leaks (soap suds): joints detached and pulled to failure:

No. 1 failed at 130.052 lbs.—broke 4" from weld
No. 2 failed at 138.200 lbs.—broke 4½" from weld
No. 3 failed at 142.300 lbs.—broke 5" from weld
No. 4 failed at 141.270 lbs.—broke 5" from weld

CRUSHING TESTS.

(2) 4" Wrought pipe—Butt weld—no bevel—single bead weld. Pressure test held 1,000 lbs. oil pressure, no leaks.

Electric welded pipe placed under steam hammer and flattened to 1 7/8"—hammer stopped for inspection—weld, in fact, signs of failure in pipe. Replaced under hammer and hit one medium blow. Both weld and pipe broke in a straight longitudinal line at right angles to the weld.

(3) 8 miles—6" steel—Arc welded, test to 575 lbs. Hydraulic pressure for 24 hours—no leaks developed in welds.

(4) 15,000 feet wrought gas line for United States Government, varying 3" to 6"—Electric welded under Government inspection. Line tested to 120 lbs. air pressure—no loss of pressure at expiration of 24 hours.

VICTOR COMPANY CONTINUES TO EXPAND

Report has been received that the Victor Welding Equipment Company are now represented adequately in the following localities:

Seattle, Wash.; Portland, Ore.; San Francisco, Bakersfield, Los Angeles, Calif.; El Paso, Dallas, Houston, San Antonio, Beaumont, Texas; Shreveport, La.; Tulsa, Okla.; St. Louis, Kansas City, Mo.; Cincinnati, Ohio; Pittsburgh and Philadelphia, Pa. Additional territory will be opened up when satisfactory jobbers can be located.

The Victor Welding Equipment Company states that they have increased their business approximately 300 per cent during the last year and are looking forward towards an excellent future. The sale of Victor Welding and Cutting Equipment is not restricted to the United States but a very splendid export business has been built up.

KORO CORPORATION INSTALLS NEW COATING EQUIPMENT

During the past several weeks the Koro Corporation, Waukegan, Ill., manufacturers of welding wire, has been engaged in the installation of special equipment for coating electrodes for hand welding. A new type of coated electrodes has been developed and new equipment, which is now operating at capacity, is reported to make possible a large scale production of coated electrodes on a very economical basis and with very uniform results. It is said that the new material has been used by several large production welding departments with complete satisfaction.

PRESSED STEEL TANK CO. HAS PURCHASED Seamless Steel Products

The Pressed Steel Tank Company of Milwaukee has purchased the assets of the Seamless Steel Products Corporation, also located in Milwaukee. The Seamless Steel Products Corporation manufacture cylinders, tanks, containers, and other seamless steel products. The business will be operated by the Pressed Steel Tank Company as a wholly-owned subsidiary. The change in ownership of the Seamless Steel Products Corporation will take place immediately. There will be no change in the personnel of either organization for the present. The officers of the Corporation are: H. O. Brumder, President; R. P. Dieckelman, Vice President; Herman Merker, Secretary-Treasurer.

HALPIN AND KOHLBRY MOVE TO LARGER QUARTERS

The firm of Halpin & Kohlbry, formerly located at 29 S. Fourth Street, St. Louis, Missouri, have recently moved to 4116 Clayton Avenue. This move increases their facilities to the point where they feel sure that they are in a position to give the most complete electric welding service throughout the St. Louis territory. The warehouse, which covers about 4,000 sq. ft., is to be devoted entirely to electric welding supplies, accessories and equipment. Provision has been made in the new location for the operation of a few welding sets so that experimental work and research work can be done. This company, while being actively engaged in the machinery business, has specialized considerably in electric welding and are now representing the General Electric Company on their complete line of electric welding equipment. They have also been appointed distributors throughout the territory for the products of the C. H. Hollup Corporation, Chicago.

SMITH WELDING EQUIPMENT CORPORATION ERECTING NEW BUILDING

Contract for the construction of a two-story and basement addition to the plant of the Smith Welding Equipment Corporation and the Commercial Gas Company of Minneapolis, has been let to the J. C. Nelson & Sons Contracting Company of Minneapolis as a step in an expansion program. This is the second expansion within the past six months.

The plant is located at 2619-2633 Fourth Street Southeast, Minneapolis. The present two-story building was erected in 1920 and has 30,000 square feet of floor space. The addition will bring 14,000 square feet more. It will have a frontage of 62 feet and a depth of 75 feet. Construction work will be hurried so that the new space will be ready for use in June.

The first floor of the new addition, will be used by the Commercial Gas Company. The basement and second floor will be occupied by the Smith Welding Equipment Corporation. The second floor will be used to give increased facilities to the engineering and experimental departments, and the basement will give additional stockroom space for raw material and semi-finished products.

Large Gas Holder Removed in Short Time by Cutting Torch.

This is the second expansion for the Smith Welding Equipment Corporation within the last six months. Last December, a one-story warehouse, 75 by 75 feet was built, and the size of the office was doubled.

To make room for the new building it was necessary to wreck and remove a large all welded gas holder. This work was done under contract by the Industrial Welding Company of Minneapolis. Two cutters, each with a helper, were put on the job. The work was well organized and in less than a day and a half the huge tank had been cut into sections and all removed. The accompanying photograph illustrates how oxy-acetylene equipment helped to make easy a job that otherwise would have been difficult and costly.

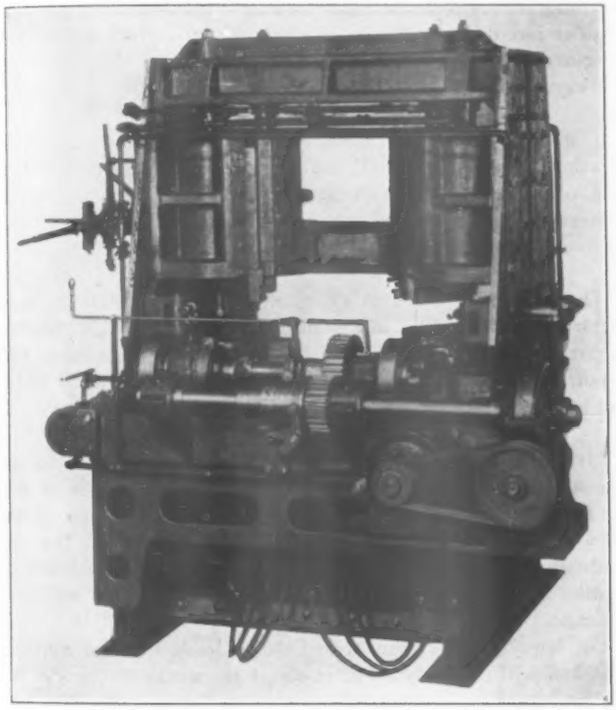
MODERN ENGINEERING COMPANY ESTABLISHED AT MEMPHIS

A new welding supply firm known as the Modern Engineering Company, with offices and storeroom at 353 Madison Avenue, Memphis, Tenn., has been organized to serve the entire Memphis territory, including northeastern Louisiana, Arkansas, northern Mississippi, northern Alabama, western Tennessee and western Kentucky. The new firm will sell Meco apparatus and a complete line of welding supplies for

electric and gas welding. A large stock will be carried and a repair service station for repairing all makes of apparatus will be maintained. The president of the new company is Mr. Fred C. Heppel, formerly sales manager of the Beaird Corporation at Shreveport, Louisiana.

NEW THOMSON COWL WELDER

A new cowl welder has recently been announced by the Thomson Electric Welder Co., Lynn, Mass. The machine is fabricated from heavy steel castings, structural plate and structural shapes. There are four clamping cylinders operated from a single Oilgear pump. The pushup pressure and movement is obtained through direct motor driven cam having a cycle of seven seconds. The speed reduction between the motor and the cam shaft is obtained through a Texrope drive and standard gear reduction unit. Because of the width of the machine two identical cams mounted on a common shaft are used for obtaining the pushup movement and pressure. The return of the mov-



Butt Welder for Sheets up to 44 in. Width

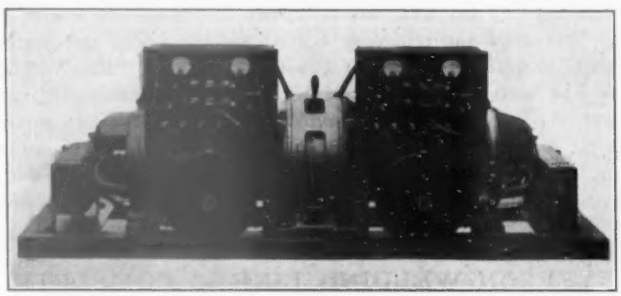
able platen to open position or loading position is by means of two air cylinders. The transformer is rated at 250 KVA and current regulation is obtained through separate auto transformer. There are also besides the four vertical clamping cylinders, four small horizontal clamping cylinders for clamping vertical flanges on the outer edges of the cowls. Special features for aligning and backing up the clamping dies are incorporated. A welder of this design could be adapted to various shapes of cowls, and with minor changes also be made suitable for butt welding wide thin sheets up to approximately 44" in width.

SIGHT FEED ADDS FLOODLIGHT TO GENERATOR LINES

The Sight Feed Generator Company, West Alexandria, Ohio, recently added a series of acetylene floodlights to their line of acetylene welding and cutting generators. The principal products of this company are the type P portable acetylene generators, which have been approved by Underwriters Laboratories. One distinguishing feature of this generator is that the carbide is kept in a transparent hopper so that the amount of carbide in the hopper is visible at all times. The operation of the generator is simple. The upper end of the hopper is closed by diaphragm having a coiled spring pressing on the upper side and supporting a free swinging steel rod on the lower side, the rod having a circular groove near its lower end. There is no clock work nor weight or other operating mechanism. Using gas from the generator lets down the diaphragm and rod until the groove enters the whole in the lower end of the hopper just far enough to let the small granules of carbide fall to the water at a rate to maintain the desired working pressure. Each particle of carbide forms such a small amount of acetylene that the pressure holds very steady. An adjusting screw on the hopper permits operating at any desired pressure. The simplicity of design and operation makes the equipment easily portable so that it is well suited for such work as scrap yard cutting, steel mill work, pipe line welding, etc. These generators are made in four sizes, up to 100 pounds capacity, and can be obtained with a specially constructed truck which holds the generator and also an oxygen tank. Standard carbide known as 14 N. B. is used in this generator. This is a standard size carbide, the pieces being so small that the gas generation is steady and cool. Any desired working pressure up to 15 pounds per square inch may be obtained from the generator. The Sight Feed Floodlight makes use of a generator of the same general principal of construction. These are made in 6 pound and 10 pound carbide capacities. A series of tests recently constructed on these floodlights have shown such satisfactory results that plans are being made to manufacture them on a large scale as the demand increases.

DOUBLE GENERATOR SETS OF NEW DESIGN

An interesting development in the production of electric arc welding machines is illustrated in the accompanying photograph of the two-arc motor generator recently put on the market by the Electric Arc Cutting and Welding Company, Newark, N. J. The manufacturers point out that while it appears on the surface that any two similar generators will multiple if the proper leads are placed together, that such is not the case, the difference in regulation of self regulated generators being such that generators have to be paired if they are to share the load beween them. Even so they do not always remain definitely parallel, it is said, the characteristic of the arc being so unstable allowing one man to take more or less of the load ir-



Two-Arc Welding Generator

respective of the generators similarity. This has been overcome in the case of the generator illustrated in the following unique manner: When multipled the current from the armature of the first generator goes through the series field of the second generator and the armature current of the second generator goes through the series field of the first. This cross connection prevents one generator from taking up all of the load. Further more this same arrangement will allow the generator to be put in series so that high voltage for cutting or for carbon arc welding or for heavy bronze welding can be obtained. Briefly the advantages secured from separating these two generators in this way are independent control and adjustments and a reduction in the power consumption. It is thought that there is a considerable field of usefulness for the new type of generator.

OXWELD ISSUES BOOKLET ON HIGH TEST WELDING ROD

The Oxweld Acetylene Company has recently sent out a new publication entitled "High Test Welding Rod." This booklet is divided into two major divisions, the first gives reasons for specifying High Test Rod, and the second tells how to use this rod to the best advantage.

The points covered in the first division are in general: The present demand for superior welded joints, a brief historical development of High Test Rod, the strength of joints made with this rod based on extensive testing, where to specify it, and the economy of its use. The second division covers briefly the principles of joint design and the actual welding technique to be employed by the welder in order to secure maximum results.

ELKON ANNOUNCES NEW REPLACEABLE SPOT WELDING TIP

A new four-page leaflet received from Elkton, Inc., announces their new replaceable Elkonited tip for spot welding. The leaflet describes the tip with its water cooling system, and shows an actual size view of the complete outfit. A print of a letter from Mr. Peter Fassler of the Fisher Body Corporation who designed the tip tells of the advantages of its use, and on the last page of the leaflet specifications and prices are given.

SHAPE CUTTING MACHINE FOR MASS PRODUCTION

The General Welding & Equipment Company, 66 Brookline Avenue, Boston, Mass., has perfected a new type of mechanically operated oxy-acetylene cutting torch known as the Geweco Universal Type No. 2. This machine has a maximum cutting range of 22 ft. x 4½ ft. It is especially designed for manufacturers who wish to reproduce heavy and intricate forgings and castings by shapes cut from rolled stock or roughly preforged billets. Shapes are cut to very close dimensions and very often require no finishing. Shapes cut in this way can be assembled by welding at very low cost, and over a wide range of production. The automatic cutting machine shows great advantages over hand cutting.

FLUX AND RODS FOR CYLINDER WORK

Kansas City Oxygen Gas Company are marketing a line of flux and rods for repairing scored cylinders, cracked water jackets and radiators, under the trade name of "Rep." The flux has been specially developed as an aid to timing operations on cast iron. It is claimed that it will tin any metal except aluminum, that it dispenses entirely with preheating and uses a very small flame. Scored cylinders tinned with Rep flux can be filled with Rep rods without removing the block from the chassis.

RYERSON WELDING LINE IS COMPLETE

Joseph T. Ryerson & Son Corporation, with offices in 20 of the principal cities of the United States, has long been known as an important supply house for iron and steel products, maintaining large stocks of all kinds of iron and steel and make a special feature of its facilities for quick delivery. The firm has gradually built up an important trade in welding equipment and supplies and now offers a complete line of equipment for oxy-acetylene, electric arc and electric resistance welding, including welding wire and all accessories.

NEWS OF THE WELDING TRADE

Mr. R. A. Witherspoon of the Shawinigan Products Corporation is scheduled to preside at the Monday afternoon meeting of the American Electro-Chemical Society, to be held May 26th in the Mining Building at Toronto University, Toronto, Canada. This session is devoted to an informal open discussion on industrial topics.

Professor C. A. Adams of Harvard University, a director of the American Welding Society, read a paper on welding before the Boston section of the American Society of Mechanical Engineers, held at the Engineers' Club, Boston, on April 22nd.

Report has been received of the incorporation of the Texas Boiler & Welding Company at Breckenridge, Texas. The incorporators are E. E. Day and V. P. Powell and the capitalization is said to be $15,000.

The A. M. Castle Company, specializing in iron and steel supplies, with headquarters at 1500 North Branch Street, Chicago, and offices in eight western cities, have recently established a welding supply department. They are handling Page Armco welding wires and Westinghouse arc welding equipment.

An illustrated lecture by Mr. C. Curtayne, entitled "Electric Welding Hints for Practical Welders," was the feature of the regular monthly meeting of the Victorian Institute of Welding Engineers, held in the main lecture room of the Workingmen's College, Melbourne, Australia.

The Clyde Equipment Company, Portland, Ore., and Seattle, Wash., recently announced that they have taken on the Smith line of oxy-acetylene welding and cutting equipment, manufactured by the Smith Welding Equipment Corporation of Minneapolis, Minn.

The Lincoln Electric Company, Cleveland, Ohio, have started the publication of a series of bulletins entitled "Studies in Structural Arc Welding." The first of these illustrates how a new 25-story building was connected silently to an old building by arc welding.

Mr. and Mrs. Findlay left in a party for California on January 19th to enjoy the balmy sunshine and breezes of this sunny land, after having been busily engaged in the throes of a merger of the Acme Oxy-Acetylene Co. and the Air Reduction Sales Co. and did not return until the middle of April. Mr. Findlay's office is now at 514 McCormick Building, Chicago.

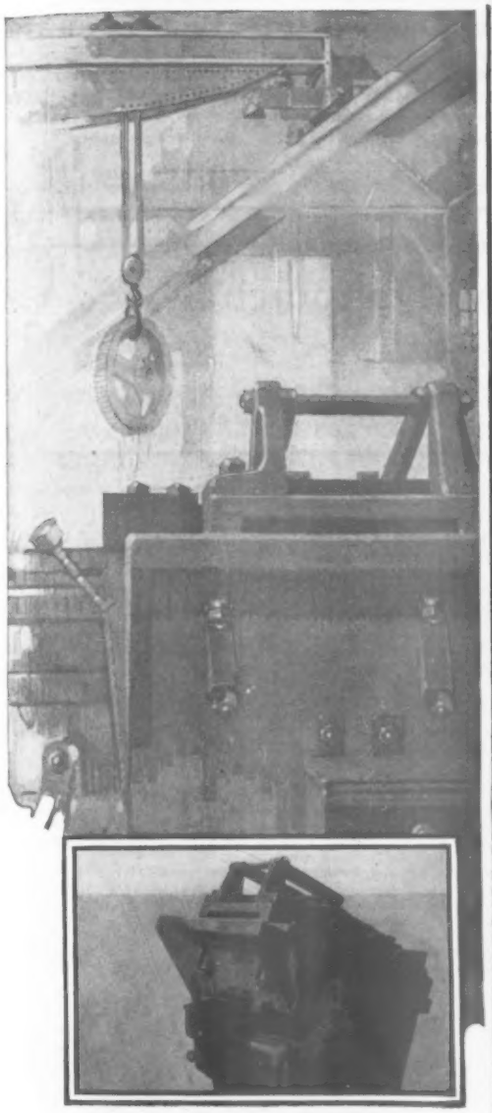
On May 16th Mr. and Mrs. Findlay leave for Hot Springs, Va., and will probably be gone about six weeks.

The C. H. Hollup Corporation, 3333 West 48th Place, have purchased the Transportation Engineering Corporation, Bush Terminal, New York, manufacturers of welding wire and equipment. Charles F. Palmer, president of Hollup Corporation, has been elected president of the Transportation Engineering Corporation.

The New York offices of the Page Steel & Wire Company were recently moved from the Grand Central Terminal Building to new quarters in the New York Central Building at 230 Park Avenue.

Mr. L. W. Stettner, president of the Victor Welding Equipment Company of San Francisco, Calif., is now on an extensive trip throughout Europe for the purpose of studying European developments in the welding industry. Mr. Stettner will also endeavor to visit many of the foreign agents of the Victor Welding Equipment Co.

R. S. Arthur, formerly in charge of the Chicago office of the Dravo Equipment Co., has been appointed manager of the Midwestern Branch office recently opened by the Aeroil Burner Co., of West New York, New Jersey, at 176 North Wacker Drive, Chicago.



View of the repaired crusher showing the extent of the weld.

Emergency Repair Made Permanent with TOBIN BRONZE*

ONCE more Tobin Bronze welding has proved its value in an emergency. ....A badly broken spelter crusher was restored to service in less than a day—and the repair is permanent.

Several years ago, the same crusher cracked and was repair-welded with cast-iron. The weld recently gave way and the crack reopened down the side and across the front of the casting.

Preparatory to welding with Tobin Bronze, a double vee was chiseled throughout the length of the crack, and the edges pre-heated with a kerosene torch. The work was done in twenty hours—twelve for preparation and eight for welding. Eighty pounds of Tobin Bronze Welding Rods were required. The repair will now be permanent because a properly made Tobin Bronze weld permeates the cast-iron and forms a bond stronger than the casting itself.

Tobin Bronze, exclusively an Anaconda product, is the most satisfactory material for general oxy-acetylene welding because of its high strength, ductility and uniform composition. Pre-heating is usually unnecessary and many welds can be made without dismantling.

Tobin Bronze Welding Rods may be obtained from distributors of welding equipment everywhere. The name "Tobin Bronze" is stamped in every rod.

*Trade-Mark Reg. U. S. Pat. Off. and in Canada

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Offices and Agencies in Principal Cities

ANACONDA
WELDING RODS

ANACONDA

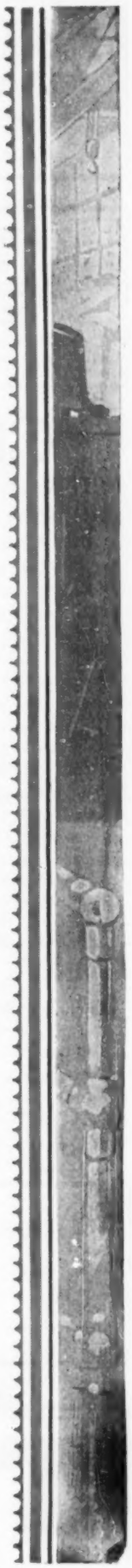
There is a suitable Anaconda Filler Rod for every welding purpose. The principal Anaconda Welding Rods, with their melting points, are listed below:

for oxy-acetylene welding

Tobin Bronze	1625°F
Manganese Bronze	1598°F
Brazing Metal	1634°F
Electrolytic Copper	1981°F
A. B. Naval	1625°F
Everdur	1866°F
Silicon Copper	1981°F

for arc welding

Phosphor Bronze	1922°F
Everdur	1866°F



"STANDARD"
Welding Wire
GAS AND ELECTRIC

for sound permanent welds : : lower costs

Our costs are considerably under those of large industrial centers; ours is a one-profit wire sold direct to user from our own mills exclusively devoted to making of welding wire from raw material to finished product—hence our extremely low prices for wire that is definitely superior. Adopted exclusively by many large users.

Prices on request.

A grade for each type of work—send for samples. Standard Steel & Wire Co., Greensburg, Pa. (Mills at Bolivar, Pa.)

AMERICAN STEEL ENGINEERING COMPANY
3520 Queen Lane, Philadelphia
601 Granite Bldg., Pittsburgh

Arc Welding Equipment
Sold and Rented
Complete Supplies Stocked
Write to nearest office for descriptive circular and prices

Classified Ads

Help Wanted—75c per line, minimum 4 line
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address.

For Sale—Largest and most complete Welding Shop in city of 50,000 doing exceptionally good business. Will require $3,000 to handle and balance on terms. Shop located in the best industrial center of Michigan. Address Box 181, care of The Welding Engineer.

Excellent opportunity offered by a large manufacturer of welding equipment for man who is familiar with welding industry and who has electrical or mechanical engineering education. Sales experience along welding lines desirable but not essential. State qualifications in detail and salary now receiving to, Box 182 care of The Welding Engineer.

Position Wanted—Welder with wide experience on all metals and aircraft work desires position as foreman in job shop, or equipment salesman. Address Box 184, care The Welding Engineer.

Special Solders—Knight Bros. Special Solders stop leaks in cast iron and aluminum. 113 South Oakley Blvd., Chicago, Ill.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of THE WELDING ENGINEER, published monthly at Chicago, Illinois for April 1st, 1929. State of Illinois, County of Cook, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared H. S. Card, who, having been duly sworn according to law, deposes and says that he is the Business Manager of THE WELDING ENGINEER, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, G. H. Mackenzie, Chicago, Illinois; Editor, H. S. Card, Chicago, Illinois; Managing Editor, H. S. Card, Chicago, Illinois; Business Manager, H. S. Card, Chicago, Illinois.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) The Welding Engineer Publishing Co., 608 S. Dearborn St., Chicago, Ill.; G. H. Mackenzie, 7321 So. Shore Drive, Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is. (This information is required from daily publications only.)

H. S. CARD.

Sworn to and subscribed before me this 27th day of March, 1929.
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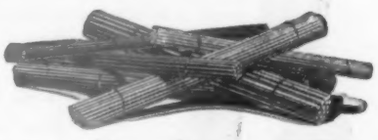

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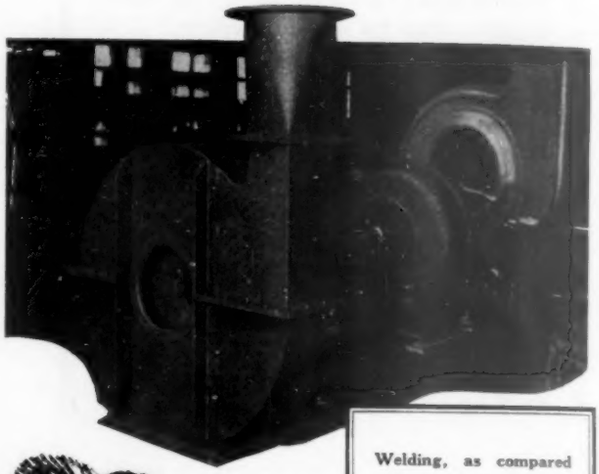

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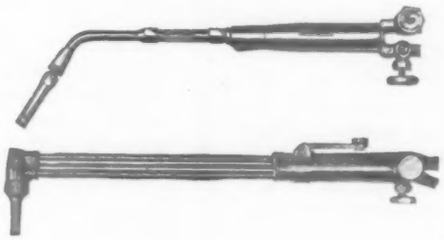

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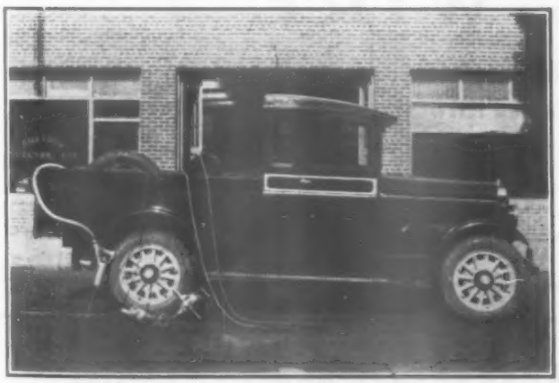

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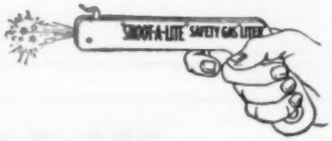

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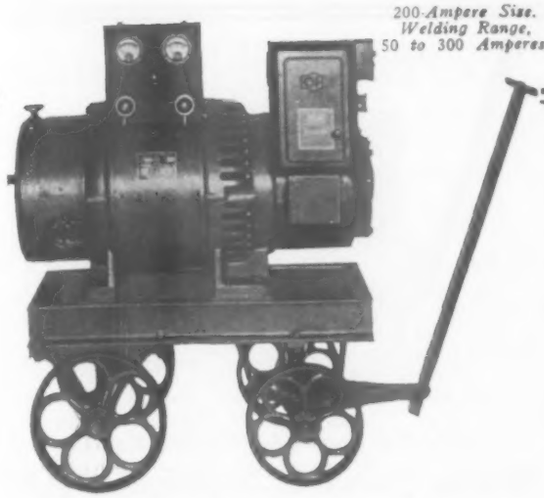

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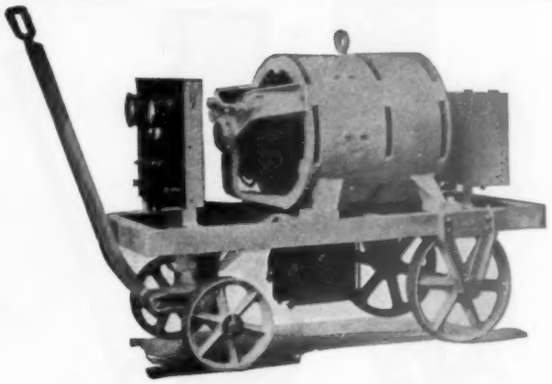

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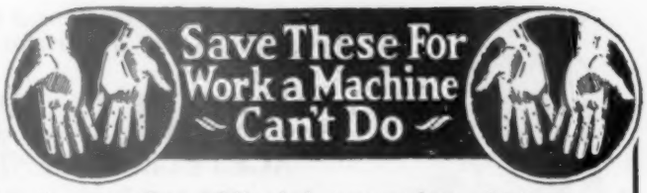

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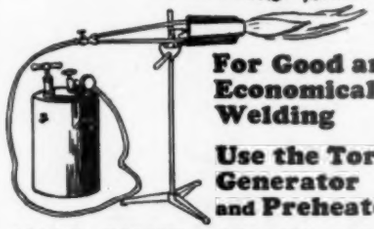

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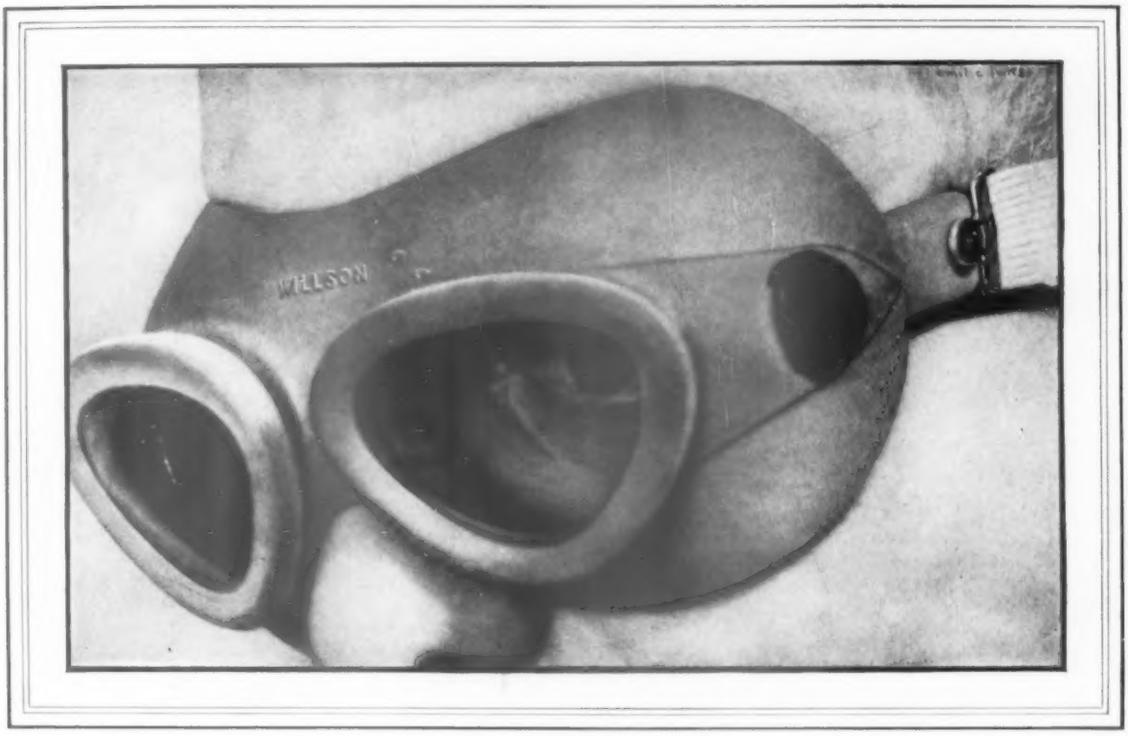

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